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SOLVING ECOLOGICAL PROBLEMS IN MINING, BENEFICATION AND METALLURGICAL INDUSTRIES IN BULGARIA

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ABSTRACT: The ore mining, flotation and metallurgical operations highly influence on the components of the environment - the free air, surface and subterranean water, soil. In Rudmetallurgproject JSCo a number of research and design work dedicated to solving the resulting ecological problems in this area are carried out. This overview paper deals with the principle zones İn Bulgaria exposed to the negative effect on its environment caused by the non-ferrous metallurgical plants.

The ore mining operations, especially in open pits causes emission of large quantities of mined mass - rubble and low-grade sulphide and oxide ores- that is carrier of different in quantity and degree of toxicity components The balance of the environment is disturbed by the disposal of the mined mass and building up waste heaps : the configuration of vast areas from the terrain in the region is disturbed and appear conditions for occurance of oxidizing and bio-oxidizing processes in the massive of the heaps and toxic components leaching with the drainage of meteoric water. In this way conditions for contamination of surface water and soil occur.

Eleven principal zones are determined with attacked water intakes from the non-ferrous metallurgy works in Bulgaria. (Fig. 1.) The zones are located along the nver valleys of the rivers Ogosta, Iskar, Maluk lskar, Strouma, TopolnİtsA, Louda Yana, Chepelarska, Arda, Toundzha, Kamchiya, Batova and the rives flowing through the South part of the Black Seaside

Contaminants of the rivers are the underground mines and open pits for production of copper, lead-zink, iron and manganese ores, the flotation plants, the plants for Iffching of copper oxide ores and the metallurgical plants for production of copper, lead and zinc and for processing of non-ferrous mêlais

Waler consumption of the flotation plants and metallurgical plants amounts about 150 billion cubic metres per annum, generating waste water together with the mine water about 100 billion cubic metre per annum.

The examination of the control on waste water from the ore mining, ore-dressing and metallurgical. operations m Bulgaria reveals that there appear pollution exceeding the permissible environmental standards as follows

1st zone - ore mining and ore-dressing operations - suspended matter

2nd zone - ore mining, ore-dressing and metallurgical operations - suspended matter, sulphate ions and ions of the metals, copper, zinc, manganese, iron and arsenic

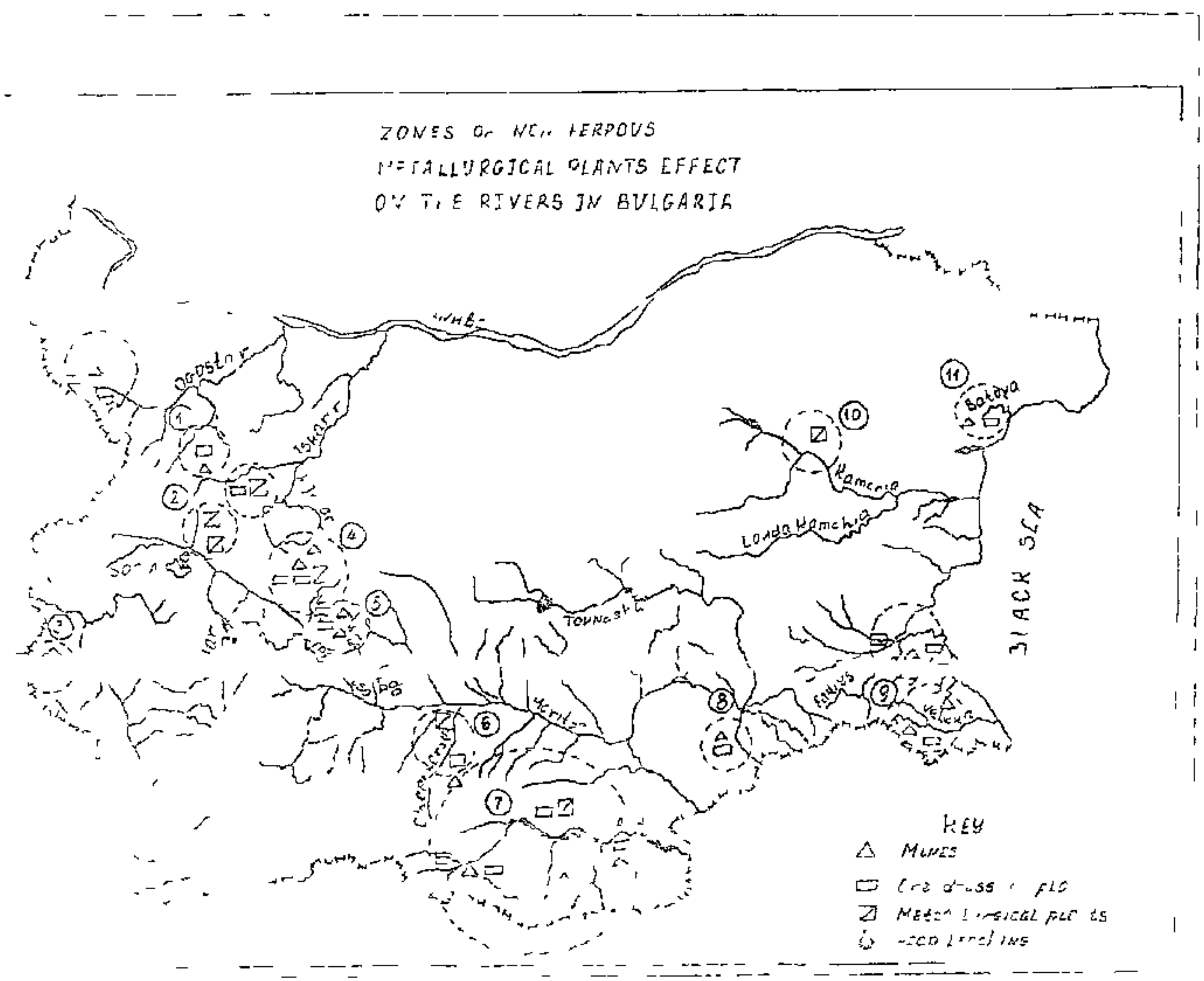
3rd zone - ore mining and flotation operations - suspended matter

4th and 5th zones - ore mining, flotation, metallurgical operations and leaching copper oxide ores - suspended matter, sulphate ions and ions of the metals copper, zinc, manganese and iron

6th zone - ore mining, flotation and metallurgical operation - suspended matter, sulphate ions and ions of the metals copper, zinc, manganese, iron and cadmium

7th zone - ore mining, ore-dressing and metallurgical operations - suspended matter, sulphate ions, cyanide ions, manganese, iron, cadmium, arsenic

8th zone - ore mining and flotation operations - suspended matter, cyanide ions, ions of copper and zinc metals.


ZONES OF NON FERROUS
METALLURGICAL PLANTS EFFECT
ON THE RIVERS IN BULGARIA
BLACK SEA
Kamchia
Louda Kamchia
Tounsha
Maritza
Iskar
Ogosta
KEY
Mines

9th zone - ore mining and flotation operations - suspended matter.

10th zone - metal-processing facilities suspended matter.

11th zone - ore mining and ore-dressing operations - suspended matter, chlorine ions *and* ions of the manganese and arsenic metals.

The factories located in the first and third zones have a weak effect on the nvers Ogosta and Strouma. The same is valid for the ninth and tenth zones and the rivers in the South region near the Black Sea and Kamchiya. The most severe effect is on the rivers Iskar, Maluk Iskar, Topolnitsa, Louda Yana [L. Tsotsorkov, 1966], Chepelarska and Arda effected by the factories in the 2nd, 4th, 5th, 6th and 7th zones.

In Rudmetallurgproject JSCo are carried out a number of research work dedicated to finding solutions of the various existing ecological problems. Technologies for treatment of mine water, waste water from the mines, flotation factories, metallurgical works have been developed, as well as some designs for water treatment plants (V.Zagorski et al., 1987, Z.ZIatev, 1981, Z.Zlatev,1968).

A universal contaminant of the waste water is suspended matter The difficulties for its removal are due to its relatively low content in the waste water - (up to 1-2 grams per litre) and the fine dispersivity of solid phase - the fraction of minus 10 microns is approx 80%

The possibilities for shortening the sedimentation time for the solid phase by adding coagulants - calcium oxide, ferro- and fern-sulphate, fernchloride, aluminium sulphate and flocculants Magnafioc, Zetag, Badimol, etc have been examined

The possibilities for treatment of the waste water resulting in removing the ions of the metals copper, zinc, cadmium, iron, manganese, arsenic via applying vanous methods - settling of metal hydrooxidcs, sorption with resins and inorganic sorbents , extraction , electrochemistry (A.Alexandrov, 1983), etc have been studied Flowsheet diagrams have been developed for ion-exchange recovery of copper from waste water via resins VPK, ANKB-7, KB-4x10, etc, of zinc via VOFAV1T-KPS. KU-2x8, etc, of cadmium via KU-2, CS-3, AMBERUTfi and others

Removal of the sulphate ions from the waste waler is technologically feasible, but it is too expensive flic possibilities for removal of the sulphate ions from the waste water via resins - strong-alkali, medium alkali and ampholytes are examined. It is found that the best technological properties have the high-alkali anionites.

For the flotation plants the main technological and engineering solution *for protection of the* water intakes in their regions is the application of circulating water-supply systems. In the plants conditioning of water is not required for beneficating Cu ores. In flotation procedure of lead and zinc ores the more complicated reagent conditions results in accumulation of components requiring conditioning of the circulating water by means of chlorination, treatment with acidic or alkali reagents, etc. For avoiding fouling in the pipelines of the circulating systems, the return water is stabilized via treatment with acidic or alkali reagents.

Both for the metallurgical works and ore-dressing plants the main tendency is application of circulating water-supply system.

The technologies developed provide hydroxide settling of heavy non-ferrous metals and ferrous metals and water stabilization aiming at circulating water supply route.

Besides the treatment of the contaminated mine water, the problem of the pollution of the nvers in. the region of mines and mining operations can be solved also by means of some other solutions.

In Rudmetallurgproject JSCo are developed technological and engineering solutions for minimizing and ceasing the progress of the processes of oxidation, bio-oxidation and leaching from the mass and heaps, built up in the mines areas Technologies have been developed for complete alkali treatment only of the top 2-meters" layer of the heaps [Z.ZIatev, et al., 1996|, with subsequent land reclamation With its application is to be achieved maximum reduction of the nsk from contamination of the nvers by draining through the banks of meteoric water A technical solution has been winked oui for post-treatment of drainage watei via carbonate filtei s

CONCLUSIONS

The summary and analysis of the studies made and research and design work conducted on the effect of ore mining, flotation and meialluigical activities m llulgiina on sonic components of environment form the hasi: for ilie following conclusions to be made

1 Mine and waste water from the plants of non-ferrous metallurgy cause a certain effect on the nvers in the region of its ongin. The major contaminants entrained with the waste water are: suspended matter, sulphate ions and ions of the metals copper, zinc, cadmium, manganese, iron and arsenic

2. Eleven zones are outlined for Bulgaria, in which the facilities of the non-ferrous metallurgy have polluting effect on the nvers The strongest effect is in the zones along the river valleys of Iskar , Maluk Iskar, Topolmtsa, Louda Yana, Chepeiarska and Arda

3. The main tendency for protection of the water intakes from pollution with waste water outgoing from the industnal facilities is the application of entire circulating water-supply systems and reuse of the treated or conditioned waste water

4. For maximum restriction of pollution of water intakes caused by open pits operations and its heaps it is considered as suitable the application of geotechnological methods for treating of heaps with subsequent land reclamation and post-treatment of the drainage water with carbonate filters.

5 When it is not possible to arrange a circulating system to be arranged, it is necessary to use combination of various chemical and technical solutions aiming at reduction of the operational costs and increasing the economic and écologie efficiency of the water treatment

REFERENCES

Zagorski, V Popov, P Zmryarov, Z Zlatev, Z Popov, L 1987. *Treatment of Industrial waste water and reasonable utilization of available water resources* (Section 2,11), Technika, Sofia

Zlatev, Z 1981 Treatment and recovery of valuable components from the lead and zinc production waste water, *Mctahurgta No.S*

Zlatev, Z. 1986 *Opportunities for utilization and treatment of waste water outgoing from the mining and benefication procedures from Obrochishte de/msit,* Minno delo,No 6

Alexandrov, A 1983 *Electrochemical methods for treatment oj mine waste wnier,* Rudmetalhirgproject JSOo records

Tsotsorkov, L 19% Mining and Geology, No 7

Zlatev, Z Zlatanova, M. Mitov, K. 1996. *Possibilities for restriction of the oxidation and leachirg processes in the refuse hanks of Elalsite* Geology and mineral resources. No. 9-10

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MINERAL PROCESSING