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THE INFLUENCE OF FERRONIKELI SMELTER IN SURFACE AND GROUND WATERS OF THE RIVER DRENICA

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SYNOPSIS

This research paper discusses about the status of some selected heavy metals (Fe, Ni, Co and Cr) in surface and ground waters that discharging in river Drenica from Ferronikeli smelter of Kosovo, using the field study data during the year 2007. As result of production process of ferronickel applied in Ferronikeli smelter the following heavy metals are expected: iron, nickel, cobalt and chrome. Measurements indicated the concentration of heavy metals and TSS in river.

The length of river Drenica is 41 km. It is a tributary of the river Sitnica that it joins at the West of Fushë Kosova, 16 km at the East of the Ferronikeli plant. The catchments area of the river is 108.35 km^2. This river is running all seasons. Visually, water quality of the river Drenica looks poor.

Heavy metal concentrations have been investigated for groundwater close to slag landfill site and surface water flowing close to smelter site. The concentrations of these heavy metals were then compared with the relevant guidelines value for a class II river. The results indicated that the extent of pollution of groundwater and surface water by heavy metals can be considered low.

INTRODUCTION

The smelter of Ferronikeli is settled in Drenas, which is located in the part of central Kosovo, 20 kilometers far from Prishtina, the capital of the Republic of Kosovo, in the west side. The plant is located on an industrial area of 81 ha. Ferronikeli smelter is well-known for final production of ferronickel.

The smelter is situated on a flat area with very light slope from the North-East to the South-West, from 620 to 590 m. At the end of the slope is found the river Drenica, running towards East at 1 km from the South limit of the smelter, at a level of 570 m. The groundwater level is then near the ground surface. This groundwater flows mainly from North-East to South-West, into the direction of the river Drenica. This ground water is likely connected with the river Drenica groundwater.

The water for smelter is supplied from the hydro-system Iber-Lepenc, 17 km from the plant. Water is then treated in an internal water plant, above the smelter. Industrial water is mainly used to cool furnaces and converters. At the end, the process rejects little water because this water is re-circulating. This water treatment plant produces also drinkable water, both for the needs of the plant and for the municipality of Drenas.

The new Wastewater Treatment Plant treats the sewage water (sanitary waters). This wastewater after its treatment is discharging to river Drenica.

The objective of the study was to examine the concentration of heavy metal in groundwater and surface water due to slag landfill and Ferronikeli plant activities and to determine the pollution level by heavy metals.

DESCRIPTION OF THE PROCESS OF FERRONIKELI SMELTER AND ITS INFLUENCE IN RIVER DRENICA

The smelter of Ferronikeli from an environmental point of view could be separated in three entities:

- Factory: Existing plant is located on an industrial area of 81 ha. The village Drenas is located 1.3 km South-West from the smelter.
- An internal slag landfill is located 500 m from the East limit of the factory. Its area is around 32 ha. This slag landfill contains around 3 million tons of granulated slags.
- Water facilities. These facilities collect water from the hydro-system Iber-Lepenc, 17 km from the plant in North-East. These facilities have an area of around 1.2 ha, at the quote 650 m.

The location of these three entities is showed in Fig. 1.

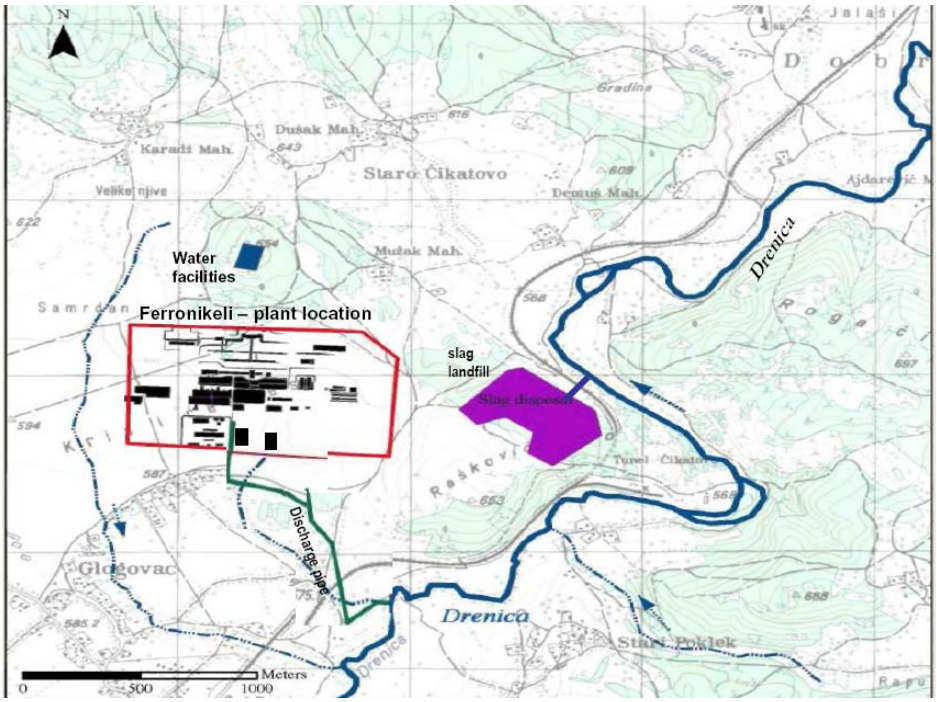

Fig. 1. Location of Ferronikeli plant, slag landfill and the river Drenica

IMPACT OF SLAG LANDFILL IN THE RIVER DRENICA

Around 3 millions of tons of granulated slag are stored from the past. This granulated slag is very light material with a low density. During its dumping on the landfill, they must be regularly covered by ground. This covering will avoid:

- The flying of this light material;
- Their washing by the rainfalls, carrying them away near by river Drenica.

Table 1. Chemical composition of slag from electric furnace

EF slag	Fe total	Al_2O_3	SiO_2	MnO	MgO	Cr_2O_3	CaO	Ni	Co	FeO
%	15.81	2.16	59.67	0.41	14.01	1.48	3.05	0.08	0.01	20.39

In 1997 were taken water samples from the following locations:

- Open canal flowing from the granulated slag landfill to the lower river Drenica. When slags are dumped on this slag landfill they are wet because they are coming from the sedimentation pool. This internal water and the rainfalls were running down to the river Drenica;
- Drenica River, upstream the discharging point;
- Drenica River, downstream the discharging point.

Table 2. Analyses of the metallic elements into the water

Metals	Unit	Open canal	Drenica Upstream	Drenica downstream	Class II (1)
Iron (Fe)	mg/L	0.12	0.11	0.077	0.3
Zinc (Zn)	mg/L	0.02	0.015	0.02	0.2
Copper (Cu)	mg/L	0.005	0.002	0.002	0.1
Cadmium (Cd)	mg/L	0.00	0.00	0.00	0.005
Lead (Pb)	mg/L	0.025	0.042	0.052	0.05
Nickel (Ni)	mg/L	0.007	0.00	0.00	0.05
Chrome (Cr tot)	mg/L	0.03	0.00	0.00	0.1
Mn	mg/L	0.017	0.032	0.02	0.05

(1): Maximum guideline value for a class II river (Drenica)

Results show that:

- Metallic elements 'constitutive' of the slag are poorly dissolved in the water;
- Even in the canal, metallic elements are below the regulation guideline values;
- This slag does not impact the river Drenica.

However, a leaching test must be completed.

TREATMENT PLANT AND THE IMPACTS OF FERRONIKELI WASTEWATERS THAT DISCHARGING IN THE RIVER DRENICA

As a method of sewage treatment in Ferronikeli plant is selected biological treatment with the activated sludge and particularly its variation of extended aeration. This is a suitable method because:

- It's characterized by extraordinary quality of effluents traits.
- It's characterized by relatively low sludge production.
- Demands simple operation and low maintenance costs.

Besides, the growth process of the microbes – because of the pro-longed time of sludge retention in the aeration tank – remains in the endogenous respiration phase resulting in the total oxidation of the produced sludge so that it doesn't require any further stabilization.

The treated effluent can be used for irrigation or be disposed in absorbent pits or other receiving agents of the area (e.g. torrents).

The produced sludge can be periodically removed by a suitable vehicle or dewatered according to the needs.

The wastewaters of Ferronikeli plant after treated in Sewage Treatment Plant are discharging through a discharge pipe into the river Drenica.

The impacts of wastewater and generally the production process of ferronickel in the river Drenica are presented below by results of ground and surface samples taken in some selected sites in river.

RESULTS

HEAVY METALS IN THE GROUNDWATER

The inorganic pollutants detected in the groundwater samples from a three wells are iron, nickel, cobalt and chromium. These wells are located within private houses and allow good controls of the groundwater flowing from the site. Table 3 shows the distribution of heavy metals in the ground water surrounding the sites.

Table 3: Heavy metal pollutants in groundwater samples

Dec-07					Heavy metal concentration by AAS [mg/L]			
No.	pH	T (°C)	κ (µS)	TSS [mg/l]	Fe	Ni	Co	Cr
1	7.57	6.4	1264	45.5	0.021	0.002	0.006	0.012
2	7.64	6.8	799	48	0.023	0.001	0.008	0.008
3	7.51	9.6	940	42	0.051	0.001	0.011	0.009
Target	6.5-8.5	25	<2000	<80	0.3	0.05	0.1	0.01

Results shown in the Table 3 indicate that groundwater samples from these three private wells were found to be free from heavy metal pollution.

DISTRIBUTION OF HEAVY METAL IN THE SURFACE WATER

The heavy metal pollutants detected in the surface water samples from the river water samples were iron, nickel, cobalt and chromium. 6 samples are collected from the river Drenica. Table 4 shows the distribution of heavy metals in the surface water of the river Drenica.

Table 4: Heavy metal pollutants in surface water samples

Dec-07					Heavy metal concentration by AAS [mg/L]			
No.	pH	T (°C)	κ (µS)	TSS [mg/l]	Fe	Ni	Co	Cr
1	7.71	4.9	584	36.5	0.003	0.001	0.090	0.003
2	7.79	6.6	341	73.5	0.001	0.005	0.001	0.001
3	7.63	4.8	578	36	0.012	0.007	0.023	0.009
4	7.55	6.1	539	51.5	0.002	0.015	0.027	0.004
5	7.41	4.5	569	76	0.026	0.024	0.031	0.002
6	7.44	4.6	575	38.5	0.048	0.004	0.011	0.005
Target	6.5-8.5	25	<2000	<80	0.3	0.05	0.1	0.01

Results presented in Table 4 indicate that the analyzed surface water doesn't show contamination from the presence of the smelter Ferronikeli. However, the effluent from the slag landfill must be checked regularly. Quality of the river Drenica

remains poor, with in particular organic pollution caused by direct discharging water from the surrounding villages with no sanitary treatment.

CONCLUSIONS

The measurements clearly indicate that the heavy metal in surface water and ground water are poorly dissolved in the water and are under the guideline values and doesn't show the contamination from the presence of smelter Ferronikeli. However, the effluent from the smelter must be checked regularly in the way that not to come to any contamination in any case. And others parameters pH, temperature of water in the ending of discharge pipe from smelter and total suspended solids are very good, but, water quality of the river Drenica remains poor, not from the influence of smelter Ferronikeli, but mainly from organic pollution caused by discharging wastewater from the Drenas municipality and the surroundings villages without any sanitary treatment.

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