



Assessment of Water Quality Parameters during the Environmental Impact Assessment Process for Industrial Complex of NewCo Ferronikeli

Agron Veliu^{1,2*}, Vehbi Berisha²

¹ *NewCo Ferronikeli Complex L.L.C, Department of Environment*, ² *Department of Laboratory and Quality Control, 13000 Gllgoc, KOSOVA*

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Abstract: In this research paper is presented the study work performed in April 2007 during the environmental impact assessment (EIA) process for industrial complex of NewCo Ferronikeli, located in Gllgoc, Republic of Kosovo, for the purpose of the assessment of surface water quality parameters of the river 'Drenica', sediment in this water, and quality of groundwater from two wells. The industrial complex of Ferronikeli is well-known for production of commercial ferronickel, and as a result of technological process applied in this industrial complex it ranged in heavy industries. The main goal of this environmental assessment study was to present the environmental situation for water quality before restarting with production of Ferronikeli plant. The length of the river Drenica is around 41 km. Also, it is a tributary at the river Sitnica that it joins with it at the west of Fushë Kosova municipality, around 16 km from the smelter of Ferronikeli at the east side. The river of Drenica is running all seasons, but looking visually, water quality of Drenica is not so good.

Keywords: EIA, Drenica River, heavy metals, surface water, sediment, groundwater.

Introduction

NewCo Ferronikeli is an existing plant which was producing ferronickel by thermo metallurgy. The decision for the erection of this plant was taken by the Parliament of Kosova in 1978. Its construction began in 1979, while in 1984 the plant was inaugurated for experimental work. All activities were stopped in 1999 with the bombing of the plant by the NATO forces.

In 2006, NewCo Ferronikeli complex is privatized by Cunico Resources, and in compliance with the regulation on force during this time period of Kosovo country, before restarting with the production process NewCo Ferronikeli is obliged to prepare an 'Environmental Impact Assessment' in the way to evaluate the environmental situation and measures which are necessary to be undertaken in the way to have one acceptable situation in the plant area and its surroundings.

The water for the plant is supplied from the hydro-system Iber-Lepenc, about 17 km away from the plant. This water then treated in internal water facilities, located in north side of the plant. This water treatment facility plant produces also drinkable water, for both needs of the plant and for the municipality of Gllgoc. Industrial water is mainly used to cool electric furnaces, slag granulation and gas and dust cleaning treatment systems. At the end, industrial water is not discharged outside the plant because this water is re-circulating, while wastewater is treated in new wastewater treatment plant, which is erected by NewCo Ferronikeli. This wastewater, after its treatment is discharged into the river Drenica.

Subject and sampling methods of study

The objective of this assessment study was to examine the concentration of heavy metals and some necessary parameters in surface water, sediment and groundwater, due to slag disposal and NewCo Ferronikeli complex activities in the way to determine the environmental situation before restarting with production process of the plant.

Sampling and the examination methods of water samples are done according to standard method guideline for environment impact assessment of surface and ground water (DOE, 1997 and APHA, 1998). Guideline values from Kosovo for the environment were not available at the time of this study.

*Corresponding: E-mail: agron.veliu@yahoo.com, Tel: +386 49 784 579; Fax: +381038585109

Surface water and sediment sampling

Four samples were collected in the river Drenica and the sampling is realized on 10th April 2007. The effluent flowing from the slag disposal to the river Drenica was also sampled. This effluent shows pieces of granulated slag, even close to the river. The table 1 presents analyzed parameters for these four samples done during this assessment process.

Table 1: Surface water analytical results

Parameter	Upstream site (village)	Upstream slag disposal, downstream smelter	Effluent slag	Downstream site	Unit	Surface Water Regulations (1989) (1)
Nitrates	5.6	-	-	9.5	mg/l	50
Nitrites	3.8	-	-	0.053	mg/l	0.50 (2)
Fluorides	<0.20	-	-	<0.20	mg/l	1.0
Phosphates	0.78	-	-	0.62	mg/l	0.7
Chlorides	17	-	-	16	mg/l	250
Sulphates	30	-	-	30	mg/l	200
Ammonia and ammonium ions	<0.050	-	-	<0.050	mg of NH ₄ /l	0.05
COD	2.7	-	-	2.1	mg/l	40
Alkalinity	5.25	-	-	5.33	mmol/l	<i>No reference</i>
Acidity	0.30	-	-	0.24	mmol/l	<i>No reference</i>
Conductivity	562	-	-	580	µS/cm	1000
pH	7.68	-	-	7.76	mg/l	5.5 – 8.5
Dissolved matters	350	-	-	360	mg/l	<i>No reference</i>
As	<0.050	<0.050	<0.050	<0.050	mg/l	0.05
Ba	0.032	0.033	0.028	0.033	mg/l	0.1
Ca	71	-	-	71	mg/l	<i>No reference</i>
Cd	<0.0050	<0.0050	<0.0050	<0.0050	mg/l	0.005
Co	<0.020	<0.020	<0.020	<0.020	mg/l	0.1
Cr (total)	<0.0050	<0.0050	0.044	<0.0050	mg/l	0.05
Cr (VI)	<0.0050	<0.0050	0.024	<0.0050	mg/l	0.025
Cu	<0.010	<0.010	<0.010	<0.010	mg/l	0.05
Fe	0.0053	-	-	<0.0050	mg/l	0.2
Hg	0.00050	<0.00030	<0.00030	<0.00030	mg/l	0.001
K	4.0	-	-	3.8	mg/l	<i>No reference</i>
Mg	28	-	-	29	mg/l	<i>No reference</i>
Mn	0.0034	-	-	0.0021	mg/l	0.05
Mo	<0.020	<0.020	<0.020	<0.020	mg/l	<i>No reference</i>
Na	18	-	-	19	mg/l	200 (2)
Ni	<0.020	<0.020	<0.020	<0.020	mg/l	0.02 (2)
Pb	<0.050	<0.050	<0.050	<0.050	mg/l	0.05
Sn	<0.050	<0.050	<0.050	<0.050	mg/l	<i>No reference</i>
Zn	<0.0050	<0.0050	<0.0050	<0.0050	mg/l	3.0

Note: (1) – S.I. No. 294/1989 – European Communities, *Quality of Surface Water Intended for the Abstraction of Drinking Water (Regulations, 1989)*.

(2) - *Drinking Water Directive [98/83/EC] relating to the quality of water intended for human consumption.*

Three samples of sediment were collected and sent to the laboratory of ALS in Czech Republic for analyzing of heavy metals, PAH, PCB and pesticides. The results of these samples are shown in Table 2.

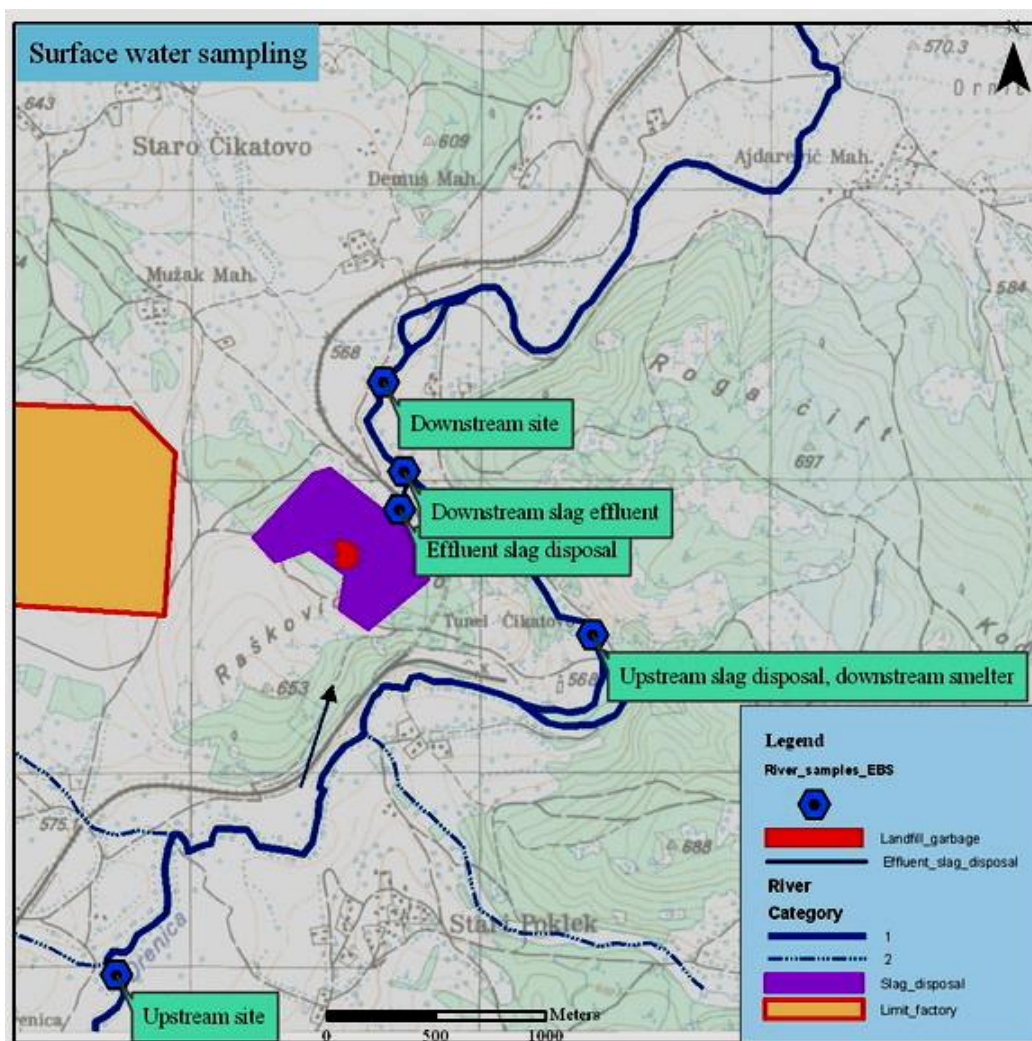


Figure 1. Surface water and sediment sampling locations

Table 2. Sediment analytical results

Parameters	Effluent slag	Upstream slag disposal	Downstream slag disposal	Unit	Florida guideline values for sediment (PEC)
As	2.6	13	14	mg/kg of dw	33
Cr (total)	47	200	230	mg/kg of dw	110
Cd	<DL	<0.50	<0.50	mg/kg of dw	5.0
Hg	<DL	0.36	<0.29	mg/kg of dw	1.1
Ni	81	350	670	mg/kg of dw	49
Pb	55	36	46	mg/kg of dw	130
Zn	26	130	170	mg/kg of dw	460
PAH	<DL	<DL	0.21	mg/kg of dw	No reference
PCB	<DL	<DL	<DL	mg/kg of dw	No reference
Pesticides	<DL	<DL	<DL	mg/kg of dw	No reference

Note: PEC - Probable effect concentration i.e. above which harmful effects are likely to be observed

Groundwater sampling

Assumed groundwater flowing direction is oriented to the south side of the plant, towards the river Drenica. Samples were taken in two sites (two wells) and the sampling is realized on 11th April 2007. *Drainage well sample*: This groundwater was sampled through a borehole close to the pump station of the plant. This borehole is used as drainage to lower the roof of the groundwater in this part of the site. Level of the groundwater was around -2 m / ground. This well was not developed before sampling and collected water was muddy;

Domestic well sample: This groundwater sample was taken from a well outside of the site of the plant. This well is located within the private house and is very well located and allows a good control of the groundwater flowing from the site. Level of the groundwater was around -8 m / ground. This well was not developed before being sampled. The analyses of these 2 groundwater samples are shown in the table 3.

Table 3. Groundwater analytical results

mg/L	Drainage well	Domestic well	Unit	French guideline (sensible use)
Nitrates	<2.0	6.7	mg/l	50
Nitrites	0.030	0.026	mg/l	0.5
Fluorides	3.0	0.32	mg/l	1.5
Phosphates	0.25	0.060	mg/l	-
Chlorides	2.5	58	mg/l	250
Sulphates	17	94	mg/l	250
Ammonia and ammonium ions	<0.050	<0.050	mg of NH ₄ /l	0.1
COD	1.3	2.4	mg/l	-
Alkalinity	1.13	6.36	mmol/l	-
Acidity	0.05	0.11	mmol/l	-
Conductivity	171	910	μS/cm	
pH	7.98	7.96	mg/l	6.5 – 8.5
Dissolved matters	117	610	mg/l	-
As	<0.050	<0.050	mg/l	0.01
Ba	0.0094	0.060	mg/l	0.7
Ca	24	71	mg/l	-
Cd	<0.0050	<0.0050	mg/l	0.005
Co	<0.020	<0.020	mg/l	-
Cr (total)	<0.0050	<0.0050	mg/l	0.05
Cr (VI)	<0.0050	<0.0050	mg/l	-
Cu	<0.010	<0.010	mg/l	2
Fe	0.017	<0.0050	mg/l	-
Hg	<0.00030	<0.00030	mg/l	0.001
K	3.8	4.7	mg/l	-
Mg	2.9	33	mg/l	-
Mn	<0.0020	<0.0020	mg/l	0.05
Mo	<0.020	<0.020	mg/l	0.07
Na	5.1	67	mg/l	-
Ni	0.030	<0.020	mg/l	0.02
Pb	<0.050	<0.050	mg/l	0.025
Sn	<0.050	<0.050	mg/l	-
Zn	0.012	<0.0050	mg/l	3

Discussion of the Results

The results presented in table 1 for the surface water shown:

- Some nitrite is analyzed in the sample upstream (village). This is likely caused by organic discharge water from the surrounding houses. No sanitary system is present in this area and sewage waters are discharged directly to the river Drenica. However, concentration remains in the range of a river of poor quality.
- The presence of nickel in all the samples is below guideline values, even compared with ‘Drinking Water Directive 98/83/EC’ (nickel is not dissolved and slag disposal has no impact on nickel in the surface water);
- Effluent slag: contains chrome total but below limit value for surface water regulations (1989), shows some presence of 6-chromium but below limit value for a river of poor quality with guideline value;

The results presented in table 2 for sediment samples shown:

- High total chromium in the sediment;
- Mercury upstream (from village, most likely used batteries thrown) but below guideline value;

- Sediments are rich in nickel and total chromium but do not show a particular metal contamination;
- PAH (Polycyclic Aromatic Hydrocarbons) found in sediment downstream whereas not found upstream. These parameters show a used oil contamination (few quantity of used oil was present in slag disposal during this study).

However, the measured concentrations are very low and remain below Florida guideline values for sediment. While for the groundwater the results from the table 3 indicate that the analyzed samples do not show particular contamination from the site of NewCo Ferronikeli plant.

Conclusions

The measurements clearly indicate that the heavy metals in surface and ground waters are poorly dissolved in the water and are under the guideline values and don't show the contamination from the smelter of NewCo Ferronikeli. However, the effluent from the plant and slag disposal should be checked regularly in the way not to come to any contamination in any case.

The water quality of the river Drenica remains poor, not from the influence of the NewCo Ferronikeli plant, but mainly from organic pollution caused by discharging wastewater from the Gllogoc municipality and the surroundings villages without any sanitary treatment.

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