Research Article

The Impact of the Power Plant "Kosova" in Heavy Metal Contamination in the Sitnicë River, Groundwater and Soils around the Area

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ABSTRACT

We have determined heavy metals pollution in surface water, groundwater and soil around the plants in Kosovo, in the seasons: Summer and winter. Elements that we analyzed during this research are: As, Cd, Cr, Co, Fe, Mn, Ni, Pb and Zn. In surface and ground waters in the winter season, the highest concentration, trace elements, have shown, elements such as Fe, Mn, Pb and Zn, while in the summer season, increased concentration, particularly; Co, Fe, Mn, Pb and Ni. Also in the soil samples, we have high levels of the elements analyzed in two seasons. Based on the results obtained, compared with international standards, some of the elements have a high concentration, more than the maximum allowed, according to every international standard, in every site-sampling in both seasons. Besides the elements; Cd and Co, are permitted levels of concentration, by every European standard.

Keywords: Power Plants "KEK", heavy metals, water, river, Sitnicë, soil.

INTRODUCTION

The factual situation of the environment represents the area of power plant "Kosova". Research and analysis is done for Sitnica, passing power plants in Kosovo. The focus of the study is surface water, groundwater (wells) and the ground around the plants in Kosovo. It is a known fact, that over time, the amount of dust particles, rise from the stacks and the amount of ash, distributed by wind, contaminated more the environment with heavy metals.[1,3]

In addition to this, coal exploitation activity as raw materials for power plants, digging excavators, transfer conveyor, separation before combustion process and storage, are sources of pollution with dust and particles coal in air, water and land surface around power stations[2,5,6]. This can be deduced from the fact that waters are polluted and without any inspection and consequently we have systematic degradation of waters without an effective system of management and protection[3,7,8].

Small amounts of heavy metals may be necessary for health, but in increased quantities can cause acute or chronic diseases discharging waste water penetrate easily into underground layers, transferring different pollutants and heavy metals, which the plant absorbs and carries them into food chain[4,9,10].

On the grounds that, coal has heavy metal content, which becomes more concentrated in the combustion and knowing also the potential activity of Kosovo's power plants for more than thirty years of power producing, these complexes have made uninterrupted pollution of air, soil, surface water and groundwater. The level of concentration of heavy metals in landfills stratified represents major troubles for the public[5,11,12]. The impact of pollution from these energetic complexes, reaches several kilometres, however, we focused in the zones in most affected by this pollution, such as Sitnicë river, which traverses the lengthwise (horizontal portion) of these territories, carrying with them the general pollution, of all types, exceeding the regional and local boundaries[13,14,15]. Due to the fact that, power plants in Kosovo are coal fired ones, and by burning fossil material such as lignite, they leave waste ashes in landfills, tons of polluting particles in air, the residual in the soil etc, presenting the reason why these lands around Kosovo power plants should be carefully and frequently studied[3,5,8]. Always, monitoring and control environment enables us to take appropriate steps, with the existing methods for the prevention and elimination of pollution, where contamination can be a permanent risk to human health and organisms that live in this environment[6,15,16]. Therefore, as we know heavy metals, not easily degraded, so that the deposition of these elements in the soil for a long time, contamination and toxicity presents very dangerous for the ecosystem and the living world as a whole.[2,7,16]

MATERIALS AND METHODS

Water samples were collected in polyethylene bottles (PVC), in the quantity of two liters. On the sampling points we immediately tested temperature and pH. In addition, we also preserve the samples using 1 ml of HCl per liter. For the water treatment we used method 3015. Soil samples were collected at 15-30 cm depth, in the amount of 3-5kg, which after mixing and divisions were reduced to 1 kg of mass. The soil samples initially were dried in air, and then dried in electric oven temperature in 105° to constant weight, then milled in proper dimensions using. The treatment of soil samples were done according to method 3052.

In addition, water samples were first filtered, and then from each sample, we chose 50 ml and placed in Teflon vessels. In each Teflon vessel were added up 1ml HCl and 5ml HNO_3, then we led the samples to mineralize in microwave digestion.

After mineralization, samples drawn from microwave, filtered and then leveled up to 100 ml with distilled water.

While, for the treatment of soil samples, we initially weighted 3.5 g sample of soil and we placed in Teflon vessels, then we added 10ml of aqua for the digestion in microwave. After this phase was done, we filtered the samples and then leveled up with distillated water to 5ml.

The samples were digested in microwave digestion system, berg of type and for the measurements we used different techniques such as inductively coupled plasma optical emission spectrometry (ICP-OES) and atomic absorption spectroscopy (AAS).

RESULTS AND DISCUSSION

The results in this paper, are presented in tabular form, for each sampling points are presented the values of the concentration of heavy metals in the environment; soil, surface water and groundwater.

Table 1: The Concentration of Heavy Metals in Water Samples, with ICP-OES Technique, Winter – January, 2015.

Parameters [mg/l]	Sampling Points for Surface Water and Ground Water					
	S_0 Ref	S1-S.W	S2-S.W	S3-S.W	S1-UG.W	S2-UG.W
As	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Cd	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Cr	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Co	0.022	0.021	0.019	0.022	0.024	0.021
Fe	<0.001	0.088	0.098	0.095	0.171	<0.001
Mn	0.176	0.259	0.124	0.105	0.028	0.00
Ni	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Pb	<0.001	0.113	0.139	0.176	<0.001	0.055
Zn	0.166	0.179	0.240	0.190	0.240	0.170

Table 2: The Concentration of Heavy Metals in Soil Samples, Tested by the Method; ICP-OES, January / 2015.

Parameters [mg/kg]	Soil Sampling Points	
	S1. Wasteland	S2. Formland
As	87.36	44.22
Cd	1.26	0.28
Cr	191.40	109.98
Co	22.68	22.64
Fe	3010.70	2308.10
Mn	589.65	811.56
Ni	245.11	127.90

Table 3: The Concentration of Heavy Metals in Water Samples, Tested the Method, SAA, Jul / 2015.

Parameters [mg/l]	Sampling Points for Surface Water and Ground Water					
	S-0.Ref.	S-1.S.W	S-2.UG.W	S-3.S.W	S-1.UG.W	S-2.UG.W
As	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Cd	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Cr	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Co	0.023	0.036	0.039	0.030	0.031	0.036
Fe	0.036	0.140	0.220	0.204	0.255	0.057
Mn	0.122	0.196	0.159	0.146	0.020	0.004
Ni	0.013	0.022	0.028	0.018	<0.002	<0.002
Pb	0.00	0.079	0.117	0.093	0.00	0.043
Zn	0.20	0.27	0.32	0.22	0.19	0.16

Table 4: The Concentration of Heavy Metals in Soil Samples, Tested the Method, SAA-Jul / 2015.

Parameters [mg/kg]	Soil Sampling Points	
	S1. Wasteland	S2. Formland
As	73.20	38.14
Cd	0.76	0.19
Cr	139.03	79.19
Co	29.10	26.01
Fe	2626.19	1888.36
Mn	411.09	522.03
Ni	238.04	119.77
Pb	158.17	53.06
Zn	277.05	93.17

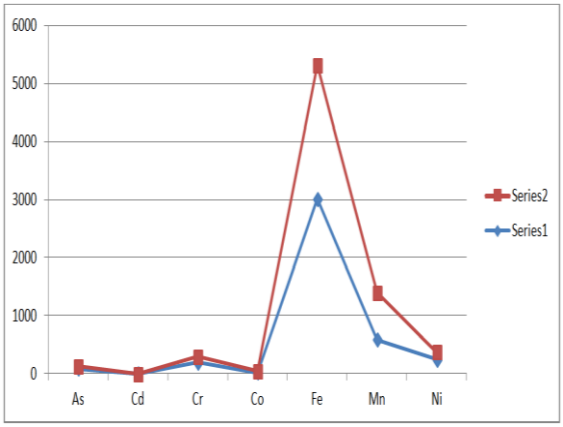

Figure 1: Graphical Presentation of Soil – Sampling Points- ICP-OES, January / 2015.

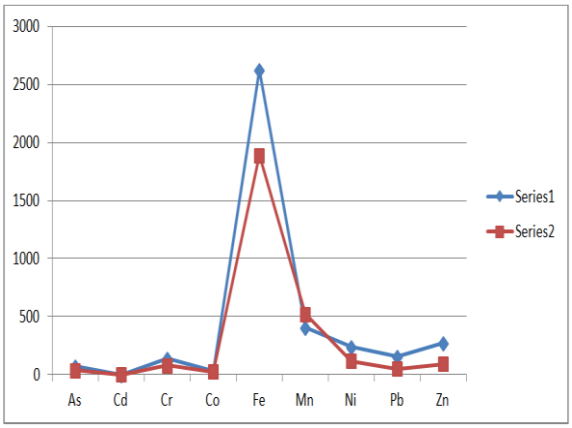

Figure 2: Graphical Presentation of Soil – Sampling Points - SAA-Jul / 2015.

The sampling point points (S2-Farmland), it has exceeded the allowed permitted values, the concentrations in of metals are as followed: As; for three, Cr; twice, Ni; 2.3 and Pb; with concentration exceeding 1.6 times. Metals Cd, Co and Zn are in permitted levels of concentrations. In the summer season, (Jul), for water, the results from Table 3 determined with AAS technique, and the same samples from table, we can conclude that there is an increase of the concentrations of heavy metals such as; Co, Fe, Mn, Pb, Ni and here is showed the presence of Ni, since last season, was not detected.

In Jul (summer season), the presence of Fe, is in concentrations; 0.036 - 0.220 mg/l in sampling point S2-SW, Mn; 0.124 - 0.159 mg/l in sampling points S1-SW and S2-SW; Pb; 0.079-0.113 mg/l in S1-SW and S2-SW sampling points; Ni; 0.022-0.028 mg/l, S1-SW and S2-SW in sampling area of study, Zn with concentration; 0.22-0.240 mg/l, in S1-SW and S2-SW.

Also, in this season of monitoring, metals; As, Cd, and Cr in surface waters and groundwater are not detected. For sampling at Jul, the analysis of the soil sample, which we refer to results from table 2 and 4, the points (S1-Wasteland) and (S2-Farmland), we have the presence of all heavy metals such as; As, Cd, Cr, Co, Fe, Mn, Ni, Pb and Zn. According to the standards for maximum permitted levels, discharging and distribution of pollutants in the soil, compared with Table 2, we have increased concentrations at the point S1-Wasteland, as the following: As; 3.3, Cr; 1.9, Ni, 3.6, and for, Pb; 4.2 times more than is allowed. According to the standards and elements; Cd, Co and Zn, are permitted levels of concentrations. While the point S2-Farmland, have exceeded the allowed values, the concentrations of the following metals: As, for two times, Cr; 1.9, Ni; 2.8 and Pb, 1.4 times allowed concentration. Elements that do not exceed the allowed concentration are Cd, Co and Zn in S2-Farmland.

CONCLUSION

In the area of power plant "Kosova" it is very clear that pollution, SO_2, CO_2, NO_X, grace, and many other potential pollutants is more than evident. These are very dangerous pollutants, which are released by the burning of fossil material, in this case, to coal burning. In the results that we gained during the experimental research, we can conclude that the presence of heavy metals such as; Pb, Mn, Fe Ni and Zn in the surface waters of rivers and groundwater (wells), is high concentration and It has contaminated water, up to the second level of pollution.

Also, analyzed soil samples have exceeded the maximum permissible concentration, compared with concentrations of international and national standards, where pollution reaches high levels of pollution, passing the maximum allowed values. Toxic elements enter the body, mainly through water, food and air, so in the near future; Kosovo's power plants should not interfere with the repair of the current filter or filters to the new place, according to European standards.

Also, the capacity of power plants must minimize burning fossil fuels and find alternative sources of energy that can orient environmental Other energy; water, wind, bioenergy and solar energy.

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