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Investigation of Polluted Zones by Lead in North West of Iran

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Abstract. National project of Important Heavy Metals Identification of Iran (IHMI), following the UNDP and supported by Department of Environment of Iran (DOE), has been completed by Modares Environmental Research Center (MERC). Due to this project the pollution potential sources was investigated by overall distribution maps of any parameters that may cause the lead pollution. Then the sampling points was determined by some geo-statistical analysis and the sampling process was done according to standard methods of sampling, preserving, transferring to lab, measuring and analyzing etc through the 3 months in three phases of materials (effluent and discharges, solid waste, water, soil and sediment samples from natural sources like river etc.). After gathering the final results, overlaying the potential sources and polluted positions (according to violation of national and international standards of sampled points) by Geographic Information Systems (GIS) led the research to closing to the pollutant sources in north west provinces (Eastern Azerbaijan, Western Azerbaijan, Ardabil and Zanjan). The synthetic and natural pollution sources observed were 17 and 20 respectively. Abir River, Niroo Gostar Taban Industrial Complex and Copper Industries were the most important pollution sources in material phases of Natural, effluent and solid waste respectively.

Keywords: Environment, Heavy Metals, Lead, GIS, Natural and Synthetic Pollution Sources

Introduction

The past 200 years has seen a rapid increase in population's worldwide resulting in the Need for even greater amounts of fuel and development of industrial chemicals, fertilizers, pesticides, and pharmaceuticals to sustain and to improve quality of life. Although many of these chemicals are utilized or destroyed, a high percentage are released into the air, water and soil, representing a potential environmental hazard Each pollutant category can impact more than one medium and each category can represent more than one process or member, e.g. the trace elements comprise more than 20 different elements (e.g. Pb, Cd, Zn, Cu, Fe, Ni, Mn, Hg etc.) During the last two decades there has been a great progress in defining major anthropogenic and natural sources of Cd, Pb and other heavy metals (Nriagu and Pacyna, 1988).

Estimates made by Nriagu and Pacyna (1988) suggest that soils are receiving large quantities of heavy metals from disposal of a variety of industrial wastes. The two principal sources of heavy metals in soils worldwide are however, the disposal of ash residues from coal combustion and the general wastage of commercial products on land. Urban refuse represents an important source of Cu, Hg, Pb, and Zn with notable contributions of Cd, Pb, and V also coming via the atmosphere. The large volumes of wastes associated with animal husbandry, logging, as well as agricultural and food production can affect the heavy metal budget of many soils significantly. Although municipal sewage sludge may not be particularly important source on a global scale, it can be one of the most important sources of metal contamination of soils on a local scale. A global

Table 1. Estimated natural and anthropogenic global emissions of trace metals to the atmosphere for selected elements (Nriagu and Pacyna, 1988).

Element	Natural (kt/year)	Anthropogenic (kt/year)	Approx. ration Anthropogenic/natural
Arsenic	1.1-33.5	12.0-25.6	1
Cadmium	0.1-3.9	3.2-12.0	4
Copper	2.2-53.8	19.7-50.8	1
Lead	0.9-23.5	287.5-376.0	27
Mercury	~2	3.5-4.5	2
Selenium	0.7-18.1	1.7-5.8	<1
Vanadium	1.6-54.2	30.0-141.8	3
Zinc	4.0-85.9	70.4-193.5	3

Table 2. Lead pollution and potential contaminant sources in North West of Iran

Province Name	Source Type	Standard Limit	Zone No.	Name of Polluted Zone	Pollutant Cons.	Situation
Ardabil	Effluent	1 ppm	–	–	–	Not Polluted
	Solid Waste	750 mg/kg	I-12	Leather 422, Khalkhal	4272.775	Potentially Polluted
	Natural	0.001 ppm	N-9	Hirochay River	0.057	Polluted
			N-7	Balkhrood river	0.056	Polluted
East Azarbaijan	Effluent	1 ppm	I-140	Azarbaijan Coating and Plating	0.875	Potentially Polluted
	Solid Waste	750 mg/kg	I-129	Simab Coating and Plating Tabriz	5210	Polluted
			I-135	Moto-Jen	1612.800	Polluted
	Natural	0.001 ppm	N-2	Jolfa River	0.067	Polluted
West Azarbaijan	Effluent	1 ppm	I-47	Niroo Gostare Taban Unit	3.143	Polluted
	Solid Waste	750 mg/kg	M-2	Zarshouran Gold Mine Tail Dam	2786.750	Polluted
			I-17	Uromieh Cement	987.500	Polluted
	Natural	0.001 ppm	N-19	Bukan River	0.057	Polluted
			N-20	Shahin Dejh River	0.038	Polluted
Zanjan	Effluent	1 ppm	–	–	–	Not Polluted
	Solid Waste	750 mg/kg	I-85	Copper Industries	9293.750	Polluted
	Natural	0.001 ppm	N-9	Abir River	0.090	Polluted
			N-1	Dandi River	0.086	Polluted

assessment of natural sources of atmospheric heavy metals has been made by Nriagu and pacyna (1988). Biogenic sources can account on average for over 50% of Se, Hg, and Mo, and from 30 to 50% of the As, Cd, Cu, Mn, Pb, and Zn, released annually to the atmosphere from natural sources. Volcanic emanations can account for 40 to 50% of the Cd and Hg and 20 to 40% of the As, Cr, Cu, Ni, Pb, and Sb emitted annually from natural sources. Finally, soil-derived dusts can account for over 50 percentage of the total Cr, Mn, and V emissions, as well as for 20 to 30% of the Cu, Mo, Ni, Pb, Sb, and Zn released annually to the atmosphere. Table 1 compares natural and anthropogenic emissions of trace elements.

A comparison of the worldwide emissions of heavy metals from natural and anthropogenic sources suggests that human activities generate emissions of heavy metals in such quantities that they significantly exceed emissions from natural sources. For Pb, Cd and Hg the global anthropogenic emissions exceed global natural emissions by factors of 27, 4 and 2 respectively (Nriagu and Pacyna, 1988).

In this direction, Modares Environmental Research Center (MERC) of Tarbiat Modarres University has implemented a national project to identify the heavy metal pollution sources in northwestern provinces of Iran under the auspices of Environmental Protection Organization. In this project, pollution sites and potentials were identified in field studies. Within three

months, various solid and liquid phases of it including wastewater, solid waste and effluent resources were subject to sampling and measurement. Then, using GIS, the data related to identifying the sites contaminated with heavy metals in the provinces under study (West Azerbayejan, East Azerbayejan, Ardebil and Zanjan) were subject to analysis in comparison with national and global standards (Khodadadi, 2009). The aim of this study was stating the results of this research in relation to heavy metal of lead.

Methods and Materials

Sampling, Preparation and Measurement Operations

The USGS sampling standard was used for sampling the liquid (wastewater and effluent) and solid (solid waste) samples of the various samples identified (Carr and Neary, 2008). For liquid samples, pH was measured, and if higher than 7, dilute nitric acid was used to avoid likely precipitates or return of the sample to liquid phase. The aqueous samples were then filtered and transferred to laboratory in 250 ml polyethylene containers for analysis. After drying, the solid and sludge samples were grinded, and the materials passing the 200 mesh were digested before feeding into the measuring instrument. In the laboratory, to measure the concentration of metals, ICP instrument was used with measuring precision in ppb level.

Identification and Analysis of Polluted Zones in Studied Province

Generally the main goals of GIS maps preparing, are preparing the pollution sources and potential distribution maps in Iran and environmental monitoring program for contaminants industries.

In the next stages the sampling and measurements results was allocated to the sample points on maps and the standards violations and quantitative comparison was created by dome bar diagrams and colour ID on the maps.

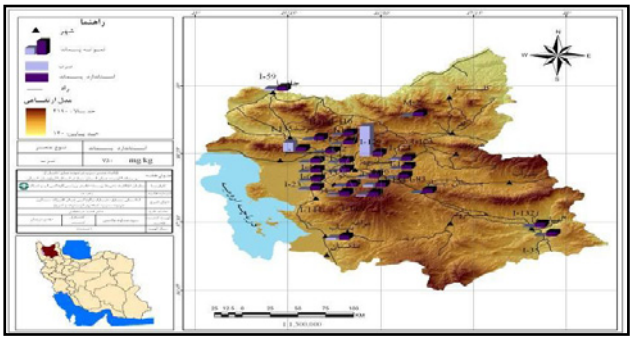

Fig. 1. Lead concentration in solid waste samples from synthetic sources at E. Az. province.

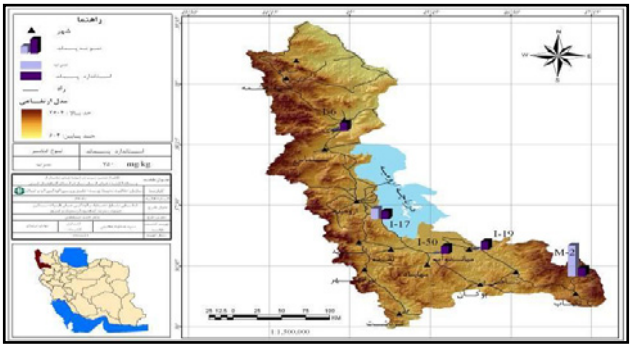

Fig. 2. Lead concentration in solid waste samples from synthetic sources at W. Az. province.

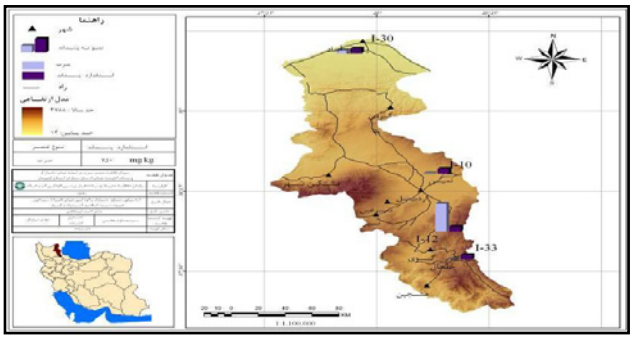

Fig. 3. Lead concentration in solid waste samples from synthetic sources at Ardabil province.

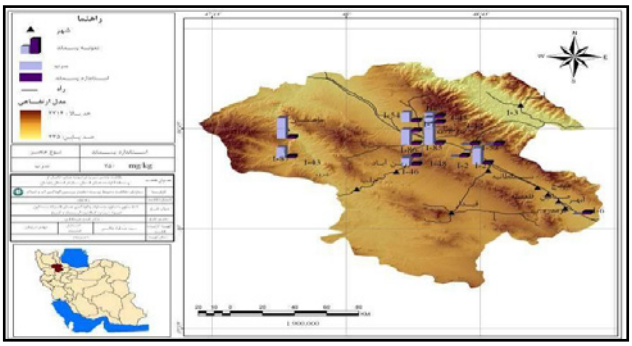

Fig. 4. Lead concentration in solid waste samples from synthetic sources at Zanjan province.

So that focusing the pollution sources, the mitigation measures and environmental management plan and monitoring program were developed (Khodadadi, 2009). 154 points were sampled and analysed overall in the mentioned provinces which some the pollutant sources results have been presented in Table 2.Some sampled points and lab analyzed results have been showed as Figures 1-4.

Conclusions

Since Lead is one of the most dangerous heavy metals which the wide spectrum of diseases caused by it, has

been the subject of numerous scientific research.
So, National project of Important Heavy Metals Identification of Iran (IHMI), following the UNDP and supported by Department of Environment of Iran (DOE), has been completed by Modares Environmental Research Center (MERC).

Through this research results from 154 points were sampled in four provinces, 37 pollution sources were ditected which Abir River, Niroo Gostar Taban Industrial Complex and Copper Industries were the most important pollution sources in material phases of Natural, effluent and solid waste respectively.

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