



## Spatial Distribution of Settled Air Pollution in Mitrovica-Comparison Between Seasons 2006-2007

Sylë TAHIRSYLAJ<sup>1,\*</sup>, Islam FEJZA<sup>1</sup>, Sabri AVDULLAHI<sup>1</sup>, Letafete LATIFI<sup>2</sup>

<sup>1</sup>University of Prishtina, Faculty of Mining and Metallurgy, Mitrovica, Kosova; <sup>2</sup>Ministry of Environment and Spatial Planning, Prishtin, Kosova

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**Abstract:** This study (research) was carried out in the city of Mitrovica, which is situated in Kosovo north with geographical coordinates 42 degrees and 53 min in Kosovo north and 20 degrees and 52 min in the east. More concretely, the monitoring covers the area in north-east part of Mitrovica, where the scope of monitoring is 7 km of air space. Total number of monitoring points is 9, which cover the urban area with a higher density of population. From the use of Lead and Zinc Mine in Stan -Tërg and activities carried out by chemical industries in the area in the past, a serious problem was caused in this part of Mitrovica in environment degradation with the created dust depositions dumps from the remains of chemical-technological processes of the mine in Zvecan and other industrial activities. These depositions are a permanent source of air pollution, which was suspended in air at any time. Exposure to certain types of settled dust and it's associated contaminant load can be detrimental to human health. In this study, we are focused on researching air pollution by dust deposition during years 2006 and 2007, and dust-fall ranged from 79.361 to 2303.10 mg/m<sup>2</sup>day according to our study, where we can conclude that there is an enormous excess in water quality according to WHO standards. We did a comparison of air pollution for this period and we monitored the meteorological conditions in the spread of dust from the created depositions from the mine use and industrial activities.

**Keywords:** spatial distribution of deposition (precipitate), deposited dust, meteorological conditions

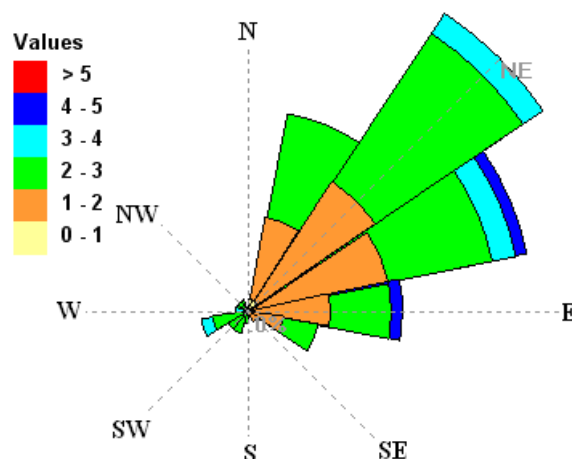
### Spatial Distribution of Deposited Dust

Depositions created from Trepça mine use and chemical-technological processes of battery factory, Zinc electrolysis and phosphoric fertilizers' factory pose a permanent source of air pollution. Considering that these depositions are not treated, and considering orograph of Mitrovica city, orograph of deposition locations, insulation process, radiation, wind speed and wind direction, these depositions are constantly under the influence of wind speed and direction of atmospheric conditions which affect the distribution of granules according to Table 1&2 and Figure 1, which cause the air pollution with different kinds of granules.

**Table 1.** Wind speed (m/s) by months in Mitrovica, 2007

<u>Month</u> <u>Direc.</u>	I	II	II	IV	V	VI	VII	VIII	IX	X	XI	XII	annual
N	346	311	277	251	252	251	227	181	199	197	225	294	250
NE	27	27	15	27	28	42	37	46	17	32	29	19	30
E	48	41	39	62	48	47	26	32	42	66	68	73	49
SE	55	75	77	50	38	28	23	30	36	48	92	91	52
S	87	107	112	109	93	47	52	49	68	96	126	109	86
SW	40	51	76	73	64	64	79	50	52	31	40	50	56
W	67	87	100	97	113	107	70	72	63	77	63	79	83
NW	37	26	68	63	64	66	99	65	45	47	57	76	56
C	293	275	236	268	300	348	387	475	478	406	300	269	338

\*Corresponding: E-mail: [stahirsylaj@yahoo.com](mailto:stahirsylaj@yahoo.com), Ttel: +37744140761, Fax: +38138540842



**Figure 1.** Wind rose of Mitrovica city

**Table 2.** Wind speed (m/s) by months in Mitrovica, 2007

Month	I	II	II	IV	V	VI	VII	VIII	IX	X	X	XII	Avrg.
Direc.	I												
N	2.1	2.6	3.6	3.2	2.4	2.2	2.2	2.1	2.8	2.8	2.8	2.2	2.6
NE	2.6	0.9	1.5	1.6	2.6	1.9	2.6	3	2.1	3	2.4	1.9	2.2
E	1.6	1	1.8	1.9	1.8	1.6	1.5	1.8	1.3	1.5	1.6	2.1	1.6
SE	1.9	2.4	3	2.8	1.8	1.8	2.4	1.3	2.2	3	2.2	4.4	2.6
S	1.8	3	1.9	2.4	2.2	2.2	1.8	1.8	1.8	2.4	1.6	2.2	1.9
SW	2.1	3.6	3	4.2	2.8	1.5	2.4	2.4	2.2	2.4	1.8	3	2.6
W	1.9	1.9	1.9	1.9	1.5	1.6	1.5	1.5	1.6	1.5	1.6	1.6	1.6
NW	3	3	3.6	2.4	2.6	2.2	3	2.8	2.8	3.6	3.4	1.6	2.8

**Table 3.** Wind direction and max wind speed in Mitrovica, 2007

Direction	N	NE	E	SE	S	SW	W	NW
Max speed (m/s)	18.9	18.9	12.3	15.5	18.9	15.5	12.3	15.5

Orograph of Mitrovica territory and the area (spatial area) that we covered through our study has favorable conditions for dust distribution from the above-mentioned dust depositions. In our study we found that there was a higher concentration of dust distribution in the monitoring points in *School "Bedri Gjina", Trepca Industrial Park, OSCE, and Tobacco Factory Bair*.

### Material and Methods

Dust deposition sampling was conducted using a Frisbee Dust Deposit (FDD) gauge, which was recently developed by the Stockholm Environment Institute and according to Ref.47 should have significantly higher collection efficiencies during high winds than both the British Standard deposition gauge and the ISO gauge.

Upward facing polythene cylindrical container with the top edge beveled at 45°. Top of the cylinder is approximately 1.7m above the ground. The sampling programmed should be long duration, e.g. 1 year, with individual exposure periods of up to 1 month.

After sampling the collector is removed to the laboratory and the insoluble deposited matter is separated by vacuum filtration and gravimetrically determined after drying. Deposition is expressed as mg/m<sup>2</sup>/day. Limited collection efficiency, dependent on wind speed.

### Results and discussion

Based on the two year monitoring of dust depositions, we did a permanent monitoring in 9 monitoring points in south-east part of Mitrovica, where these monitoring points covered

the area with a higher density of population. We usually took samples from the school locations (See Table 4).

From the monitored data, our results show a variation of obtained data through lab results where in School "Bedri Gjina", Trepca Industrial Park, OSCE, Tobacco Factory-Bair monitoring points, we have extreme values of excess according to points in Table 4 & 5, where the maximum concentration was 5560.8 mg/m<sup>2</sup>/day at OSCE sample location in April 2007, while minimum value was 40.31 mg/m<sup>2</sup>/day at Smërkovnica sample location, during August 2007.

**Table 4.** Monitoring points in southern part of Mitrovica

	Description of location	GPS mark	X coordinates	Y coordinates
1	School,,Bedri Gjinaj	AM 10	0489662	4748522
2	School „Migjeni,,	AM 11	0488265	4747292
3	Alba Park	AM 12	0490895	4747368
4	Shupkovc			
4	Smërkovnica	AM 13	0494612	4744822
5	School,, Elana Gjika,,	AM14	0491935	4751495
6	Trepca IndustrialPark	AM 15	0490302	4748422
7	OSCE	AM 16	0489662	4748522
8	Tobacco Factory Bair	AM17	0489553	4747387
9	Water Factory	AM18	0486718	4745090

**Table 5** Total deposited dust, 2007

Months	Jan	Feb	Marc	April	May	June	July	Aug	Sep	Oct	Nov	Dec
<b>Sample-locations</b>												
Scho."B.Gjina AM <sub>10</sub>	2532	2764	1430	752	627	624	581	54	74			66
Trepca Ind. Park AM <sub>15</sub>	2693	4866	5057	6437	172	2754	763	450	2064	1383	126	879
OSCE AM <sub>16</sub>	3183	4271	2950	5561	168	988	917	69	1269	919	69	1468
Tobacco Fact. Bair AM <sub>17</sub>	2421	3722	105	2480	167	617	1094	86	47	72		

In the following tables, we have presented the concentration values of deposited dust in 9 monitoring points. These values are mainly linked to the climatologically conditions during 2006 and 2007, where there are extreme values of fluctuations of all elements and meteorological phenomena.

Dominating factors in variation of values from 2006 to 2007 included climatological factors, where 2006 was characterized by a high amount of precipitation, while 2007 was the year with highest temperatures in past 50 years, where gradient of temperature was unstable. Also the baric field had huge fluctuation, and these two meteorological elements create the wind which in Mitrovica and region has up to 32 directions according to wind rose, and with a very high intensity which caused distribution of granules. Therefore, Mitrovica city and its surrounding have a high level of pollution by the amount of settled dust which is very dangerous for the health of the population. Considering the origin of the dust which comes from mine depositions created in decades and which were never treated. It is in the interest of population health that these depositions are treated professionally in order that atmospheric processes don't have an impact on suspense of granules on the air from the depositions, which are a composing substance of aerosols which are inhaling granules that directly enter organisms and have very

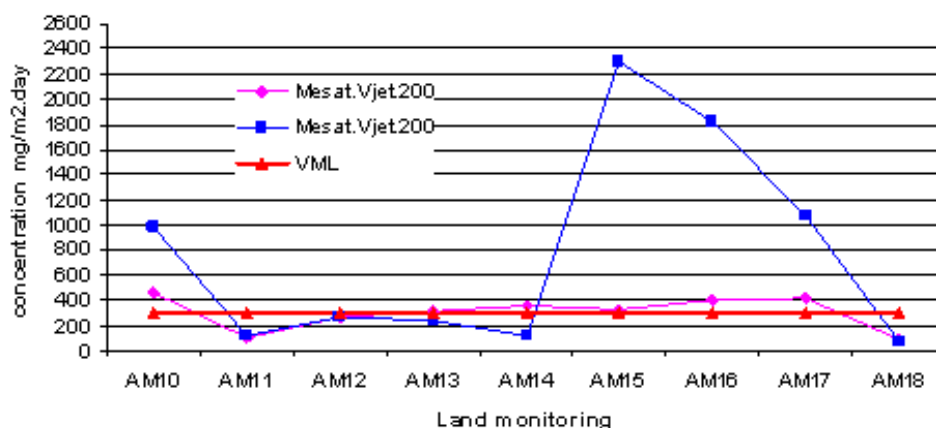
dangerous consequences. From the annual average values that we obtained in 2006 and 2007 we found that in the same points there were excesses of recommended maximum values according to WHO, which are presented in the following diagram

**Table 6.** Total deposited dust in 2006 year

Months	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
<b>Sample-locations</b>												
School "Bedri Gjina" (AM <sub>10</sub> )	107	81	215	147	89	122	205	376	88	98	147	3843
School „Migjeni” (AM <sub>11</sub> )	62	102	106	177	66	71	115	146	103	121	73	48
Alba Park „Shupkovc” (AM <sub>12</sub> )	186	213	138	258	150	271	284	266	371	380	493	179
Smërkovnica (AM <sub>13</sub> )	173	74	89	276	81	550	68	98	172	157	183	1678
School„ Elana Gjika” (AM <sub>14</sub> )	96	159	145	164	67	239	114	158	107	138	125	2753
Trepca Industrial Park (AM <sub>15</sub> )	63	99	151	195	67	97	172	119	117	159	140	2624
OSCE (AM <sub>16</sub> )	65	47	115	153	55	86	115	173	118	122	134	3597
Tobacco Factory Bair (AM <sub>17</sub> )	75	111	90	63	46	92	134	122	112	146	122	3504
Water Factory (AM <sub>18</sub> )	69	117	163	149	56	40	63	101	111	102	103	56

**Table 7.** Total deposited dust, 2007

Months	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct.	Novm	Dec.
<b>Sample-locations</b>												
School "Bedri Gjina" (AM <sub>10</sub> )	2532	2764	1430	756	627	624	581	54	74			66
School „Migjeni” (AM <sub>11</sub> )	96	122	151	111	150	85	230	78	165	70	171	68
Alba Park „Shupkovc” (AM <sub>12</sub> )	343	266	213	142	251	150	227	114	400	499	373	
Smërkovnica (AM <sub>13</sub> )	144	216	100	97	108	159	100	40	171	1314	215	199
School„ Elena Gjika” (AM <sub>14</sub> )	91	1223	85	125	154	198	114	71	122	78	83	
Trepca Industrial Park (AM <sub>15</sub> )	2693	4866	5057	6437	172	2754	763	450	2064	1383	126	879
OSCE (AM <sub>16</sub> )	3183	4271	2950	5560	168	988	917	69	1269	919	69	1468
Tobacco Factory Bair (AM <sub>17</sub> )	2421	3722	105	2480	167	617	1094	86	46	72		
Water Factory (AM <sub>18</sub> )	40	111	43	122	174	27	84	33	72	80	107	62



**Figure 2.** Annual average values of deposited dust in Mitrovica, 2006-2007, according to Table 8

**Table 8.** Annual average values of deposited dust in Mitrovica, 2006-2007

Monitoring points	AM10	AM11	AM12	AM13	AM14	AM15	AM16	AM17	AM18
Annual Aver.2006	468	99	266	319	356	334	398	411	94
Annual Aver.2007	986	125	271	239	113	2304	1819	1089	80
VML	300	300	300	300	300	300	300	300	300

**Conclusion**

- From two year monitoring of air quality by the dust deposition polluter, from the obtained values we can conclude that Mitrovica city, and its south-east part in particular has a high level of pollution with the above-mentioned granules, where the maximum value reaches 5560.8mg/m<sup>2</sup>/day, which exceeds WHO recommended values for 20 times.
- From the obtained data in our study, it can be seen that in the area of 1m<sup>2</sup>, the level of pollution is 542.3 mg per day, where the population of the region is exposed to this pollution during the entire day.
- Building of new factories poses a special problem in the increase of the pollution level, since both natural resources and air quality in the region are contaminated by technological processes which pose a hazard to the human health.
- It is required a treatment of depositions according to EU standards for these kind of depositions, where elements and meteorological phenomena could not have an impact in air pollution by the dust distributed from dust deposition of mineral and industrial remains.
- Surface water and groundwater should not be in contact with the discharged water from the drainage of the depositions, since the water from the drainage is discharged in Ibri and Sitnica rivers, and thus cause pollution in both water and soil.

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