Journal of Water Resource and Protection, **2011, 3, 182-185**
doi:10.4236/jwarp.2011.33023 Published Online March 2011 (http://www.scirp.org/journal/jwarp)

Environmental Impacts of Quaid-e-Azam Industrial Estate on Neighboring Residential Area in Lahore, Pakistan

Saadia Hina[1], Maida Zahid[2], Iftikhar H. Baloch[3], Tariq Sultan Pasha[4]
[1]*Department of Environmental Sciences, Government College University Faisalabad, Pakistan*
[2]*Meteorologist Research & Development Division, Pakistan Meteorology Department, Islamabad, Pakistan*
[3]*College of Earth & Environmental Sciences, University of the Punjab, Lahore, Pakistan*
[4]*Environment Protection Department, Lahore, Pakistan*
E-mail: saadiahina@yahoo.com
Received January 4, 2011; *revised February* 7, 2011; *accepted February* 28, 2011

Abstract

Industries have contributed for human development by improving human life styles, increasing human life expectancy rate, providing more and more jobs. Still industrialization has many negative impacts on the environment and especially on human health. This investigation was carried out to probe the impacts of Quaid-e-Azam Industrial Estate on Township area, Lahore. During this investigation wastewater monitoring and ambient air monitoring had been done. Samples from main industrial drain were collected for wastewater analysis and seventeen parameters including pH, temperature, color, odor, turbidity, conductivity, chemical oxygen demand (COD), biological oxygen demand (BOD), chlorides, oil/grease, total suspended solids (TSS), total dissolved solids (TDS), ammonia-nitrogen (NH_3 - N_2), iron, sulfate, nickel and chromium were investigated. Among them pH, total suspended solids, biological oxygen demand, chemical oxygen demand, ammonia-nitrogen were found exceeding the NEQS limits. The ambient air samples were also collected and five parameters of ambient air including particulate matter (PM_{10}), nitrogen dioxide, sulfur dioxide, carbon monoxide and noise were monitored. Among them only particulate matter was exceeding the WHO guidelines. Although there were few parameters like pH, TSS, BOD, COD and NH_3 - N_2 of water and PM_{10} of air, which do not lie within the national environmental quality standards (NEQS) limits but proper monitoring is needed to be done so that parameters may not cross their permissible limits in future. This problem must be taken into consideration by both the management of Quaid-e-Azam Industrial Estate and Governmental agencies because it is the responsibility of state also to make the environment clean.

Keywords: Industrial Estate, Water Pollution, Air Pollution, National Environmental Quality Standards

1. Introduction

Industrialization has contributed for human development as it has improved human lifestyles, increase life expectancy rate, and provide more employment. On the other hand, industrialization has negative impacts on the environment and human health. Industry has become a major contributor to environmental degradation [1]. Generally five manufacturing sub sectors are known to be big polluters. These are: iron and steel; nonferrous metals; nonmetallic minerals, chemicals, and pulp and paper [2].

Industrial pollution is far more serious in many cities of Pakistan. Industrial pollution is often increased very rapidly in the absence of an effective planning and regulation system as today many cities are developing in a very haphazard manner [3]. They are now causing the failure to plan for future systematic and homogeneous development. Smoke, dust, fumes, odor and poor zoning practices have spoiled fine residential areas [4]. Pakistan contains pollutants, which are mostly developed as a result of urbanization, modernization, industrialization, and due to the results of human activities. Most of them are non-bio-degradable, which cause negative impact on the environment [5]. When these pollutants come into the environment, they bring irreversible damage to the natural resources and ecosystems [6].

Quaid-e-Azam Industrial Estate (Q.I.E), Lahore is the largest planned Industrial estate of the Punjab Province. It was established in 1960 with the help of Canadian Government. It comprises of 477 industries, which are

spread over an area of 565 acres of land. There are medium and small scale industries in this industrial estate. Many industries are involved and working simultaneously such as food, dyeing and printing, pharmaceuticals, textiles and auto parts etc [7]. This study was carried out to investigate the impacts of Q.I.E on Township Area, Lahore as the residents of the area are under threat due to various emissions and effluents discharged from these industries. Two major aspects i.e. wastewater monitoring and ambient air monitoring had been done during this project.

2. Materials & Methods

This investigative study has two main sections. First one is wastewater monitoring and the second one is ambient air monitoring.

3. Wastewater Sampling and Analysis

Five samples of wastewater were collected from the wastewater drain at equal distances (500 m apart). Color, odor, temperature, pH and conductivity were the parameters investigated in the field and the rest of the parameters like Turbidity, Chemical Oxygen Demand (COD), Biological Oxygen Demand (BOD) Ammonia-Nitrogen, Total Dissolved Solids (TDS), Total Suspended Solids (TSS), Oil/Grease, Chlorides, Sulfates, iron, Nickel and Chromium were determined later in the laboratory by using methods described in Standard methods for the examination of water & wastewater [8-9].

Different instruments were used during wastewater analysis, which include pH meter, Conductivity meter, Turbidity meter, Colorimeter, COD reactor, Kjeldahl distillation flask and Spectrophotometer [10].

4. Ambient Air Monitoring

Ambient air samples were collected at a minimum distance of 1 km away from the Industrial estate and then analysis were carried out. In this way four samples were collected. Samples for particulate matter, NO_2 and SO_2 were collected using a respirable dust sampler in the field [11]. The absorption solutions of SO_2 and NO_2 were later analyzed through spectrophotometer by standard methods [8]. While the noise and CO were measured through digital noise meter and CO meter respectively [12].

5. Results & Discussion

The first parameter that had been investigated was the color of wastewater. It had a wide range including dirty green, brown, brownish pink, dark grey, and light grey depending upon the composition of industrial effluents drained into it. Odor was the second physical parameter that had been tested and found to be offensive due to presence of many organic and inorganic pollutants. The temperature of the wastewater samples taken from main industrial drain was below the NEQS and ranged from 35.1℃ to 38.6℃. The turbidity values of all samples fall in range of 100-500 NTU except sample 1 whose turbidity was 78 NTU **(Table 1).**

TSS value of all samples was far above the permissible limit described in NEQS that is 200 $mg \cdot L^{-1}$ except sample 1 whose TSS value was in the range of NEQS. This can reduce light penetration, decreasing algal growth, and low algal productivity of the waterways.

TDS values of all samples taken from main industrial drain were far below the NEQS limit that is 3500 $mg \cdot L^{-1}$ (**Table 1**). According to NEQS the limit for pH is from 6 - 9. The pH values at point 1 and 2 were within the NEQS range while pH values at point 3, 4, 5 were higher than the limit. At point 3, pH was the maximum i.e. 9.7 because of the presence of textile and ghee industries close to point 3. As a result of high pH values ecological misbalance can be caused if this effluent drains into stream or river.

The limit of COD must not be more than 150 $mg \cdot L^{-1}$ but COD values of all samples were greater than this limit that was from 264 $mg \cdot L^{-1}$ up to 419 mg $mg \cdot L^{-1}$. BOD values at all points ranged from 97.2 $mg \cdot L^{-1}$ to 185.4 $mg \cdot L^{-1}$ which was far more than the permissible limit, that is 80 $mg \cdot L^{-1}$ **(Table 1).** If effluents with high BOD levels are discharged into a stream or river, it will accelerate bacterial growth in the river and consume the oxygen levels in the river. Due to high BOD**,** oxygen may diminish to levels that are lethal for most fish and many aquatic insects. Permissible limit for oil and grease was 10 $mg \cdot L^{-1}$ and values of all samples were below this limit. The trend of nitrogen concentration first decreased at point 2 then increased but at point 4 it again decreased drastically and then increased at point 5 again. The amount of chlorides in main industrial drain was far less than permissible limit (1000 $mg \cdot L^{-1}$).

NEQS limit for sulfates is 600 $mg \cdot L^{-1}$ and values of all five points were below this limit. Permissible limit for iron according to NEQS is 8 $mg \cdot L^{-1}$ and iron concentration of all samples was below this limit. NEQS limit for nickel is 1 $mg \cdot L^{-1}$ and value of Ni at all points was far below this limit. Amount of chromium in main industrial drain was far below the permissible limit. Heavy metals were in low concentrations and the reason behind this is that there is no metallurgical operation in autopart industries; only their assembly is done there. Since there are very few electroplating industries, the level of Cr & Ni were low and within permissible limits.

The samples analyzed for CO had lower values as

Table 1. Results of Wastewater Parameters.

Sr No	Parameters	Unit	Results			NEQS
			Minimum	Maximum	Mean	
1	Temperature	℃	35.1	38.6	37.2	40℃ =< 3℃
2	Turbidity	NTU	78	330	211.4	-
3	TSS	$mg \cdot L^{-1}$	146	800	393.2	200
4	TDS	$mg \cdot L^{-1}$	180	326	248.6	3500
5	pH		8.0	9.7	8.96	6-9
6	Conductivity	mS	2.05	3.66	2.76	-
7	COD	$mg \cdot L^{-1}$	264	419	337.2	150
8	BOD	$mg \cdot L^{-1}$	97.2	185.4	141.3	80
9	Oil/Grease	$mg \cdot L^{-1}$	1.75	7.35	4.73	10
10	NH_3–N_2	$mg \cdot L^{-1}$	33.6	78.4	56	40
11	Chlorides	$mg \cdot L^{-1}$	258.44	347.9	301.18	1000
12	Sulfate	$mg \cdot L^{-1}$	236	527	341.8	600
13	Iron	$mg \cdot L^{-1}$	0.851	0.342	0.506	8.0
14	Nickel	$mg \cdot L^{-1}$	0.47	0.23	0.364	1.0
15	Chromium	$mg \cdot L^{-1}$	0.006	0.02	0.0156	1.0

Table 2. Results of Ambient Air Parameters.

Sr No	Parameters	Unit	Time	Results			WHO Guidelines
				Minimum	Maximum	Mean	
1	CO	$\mu g \cdot m^{-3}$	4 hours	10,000	50,000	32,500	100,000
2	SO_2	$\mu g \cdot m^{-3}$	4 hours	4.5	18.1	13.42	500
3	NO_2	$\mu g \cdot m^{-3}$	4 hours	9.2	29.4	22.27	200
4	PM_{10}	$\mu g \cdot m^{-3}$	4 hours	62.4	172.6	135.77	150
5	Noise	dB (A)	4 hours	71.6	82.6	78.1	85

compared to WHO guidelines (100,000 $\mu g \cdot m^{-3}$) which showed that the over all concentration of CO in the am bient air is far below the limit (**Table 2**) hence can not cause any bad impact on the human health. Quantity of SO_2 at all points was far more less than WHO guidelines. Permissible limit for NO_2 according to WHO is 200 $\mu g \cdot m^{-3}$ and results of all points showed that they were under this range hence cannot affect anyone. PM_{10} must not be more than 150 $\mu g \cdot m^{-3}$ but quantity of PM_{10} at point 3 and point 4 was above this limit. Higher values of PM_{10} can cause eye irritation and respiratory diseases like bronchitis and asthma. High quantity of PM_{10} can also affect plant's photosynthetic activity by blocking stomata. NEQS limit for noise is 85 dB (A) and noise measured at all four points was below this limit so it cannot have harmful impacts on community.

6. Conclusions

The two major aspects including wastewater monitoring and ambient air monitoring of Quaid-e-Azam Industrial Estate, Lahore had been taken into account during the study. Seventeen parameters were selected for wastewater analysis. All of these parameters were within permissible limit (NEQS) except pH, TSS, BOD, COD, ammonia-nitrogen.

Ambient air samples were collected at a minimum distance of 1 km from Q.I.E. Five parameters including particulate matter, nitrogen dioxide, sulfur dioxide, carbon monoxide and noise were selected for ambient air analysis. All the parameters were within the permissible limits except particulate matter (PM_{10}) that exceeded the WHO guidelines.

There were few parameters like pH, TSS, BOD, COD and NH_3-N_2 of water and PM_{10} of air, which did not lie within the NEQS limits. Therefore proper monitoring is needed so that parameters may not cross their permissible limits in future. This problem must be taken into consideration by Q. I. E Administration and Governmental agencies both to save the environment.

7. References

[1] R. K. Trivedy and N. S. Raman, "Industrial Pollution and Environmental Management," Scientific Publishers, India, 2002, pp.178-189.

[2] UNIDO, Industry and Development, Global Report, United Nations Publications, Birmingham , 1990/1991.

[3] M. Indra and S. Choudhary, "Industrial Pollution and Its Control," Aavishkar Publishers, India, 2004, pp. 1-26.

[4] M. N. Rao and H. V. N. Rao, "Air Pollution," McGraw Hill, USA, 2000, pp. 44-79 & 255-267.

[5] IUCN, "Rapid Assessment of Industrial Pollution in the Korangi Phitti Creak," 1992.

[6] A. Behbahaninia, S. A. Mirbagheri, N. Khorasani, J. Nouri and A. H. Javid, "Heavy Metal Contamination of Municipal Effluent in Soil and Plants," *Journal of Food, Agriculture Environment*, Vol.7, No. 3-4, 2009, pp. 851-856.

[7] "Infrastructure Development of QIE Lhr," *Final Design Report*, Vol. 1, 2004, pp. 1-4-2-3.

[8] "Standard Methods for the Examination of Water & Wastewater," 20th Edtion, American Public Health Association, American Water Works Association, Water Environment Federation, USA, 1998, pp. 2-56-5-39.

[9] S. N. Kaul and A. Gautam, "Water & Wastewater Analysis," Daya Publishing House, Delhi, 2002. pp. 32 -75.

[10] "Water Analysis Handbook," 4th Edition, Hach Company, USA, 2002, pp. 63-73, 91-95, 487-503, 555-571 and 964-977.

[11] Alley, E. Roberts and Associates, "Air Quality Control Handbook," McGraw Hill, USA, 1998, pp. 2.3-2.28 & 4.1- 4.33.

[12] T. I. Khan, "Atmospheric and Air Pollution Control Technologies," Aavishkar Publishers, India, 2004, pp. 230 -233.

