

60. Intensity of Noise Pollution from the Industries at S.I.T.E Area Kotri

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Abstract

Environmental pollution has become a serious problem in the world and causing dangerous and harmful effects in the biosphere, where human beings are living and are responsible for introducing pollutants in it. Kotri city is one of the largest industrial city in Sindh - Pakistan situated on the right bank of Indus river at Hyderabad with majority of textile, cotton, flour and rice mills, most of them having their own power generation units working on natural gas as source for power and the environmental pollution in the city is one of the major problems being faced by the locality of Kotri. In this project the noise pollution in the Sindh Industrial Trading Estate (SITE) area Kotri was measured by latest equipment. A survey was carried out at SITE area Kotri to check the level of noise in its vicinity area. The results concluded that majority of industries contribute to produce noise pollution above standard fixed by the Environmental Protection Agency (EPA), World Health Organization (WHO) and National Environmental Quality Standards (NEQS). It is suggested that the existing position of noise pollution need for quick action to tackle to reduced noise pollution in SITE area Kotri. The establishment of noise standards, monitoring sites extension and the development of noise pollution control plans are necessary to implant.

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1. Introduction

Noise pollution from the industries is the most extensively spreading source for noise nuisance in Pakistan. The exposure of noise causing noise annoyance in the workers of the industries and there is no any criteria for damaging the hearing capacity of them [1]. Unfortunately, very few industries are following the noise control measures while majority of industries are producing the noise pollution above the standard values (60-70 dB (A)) [2]. At 104.1 dB at the working area, almost 100%, 30%, 20%, 30% and 20% workers facing the problem of speech interference, irrigational problem, respiratory problem, headache and having the heart/BP problem respectively due to high intensity of machine noise [3]. Noise pollution produced mainly form: outdoor sources including industries, public & construction work, road, rail & air-traffics while indoor sources are live or recorded music, catering trade, ventilation system, office machines domestic animals [4]. Most of the acoustical energy of speech is in the frequency range of 100 Hz-6 KHz, most important cue-bearing energy being between 300 Hz-3 KHz [5]. Noise pollution above 80 dB (A) cause to increase aggressive and decrease helping behavior and the patients due to noise pollution having chronic heart disease, neurosis, mental illness, hypertension, stressed and sleep disturbance [6].

Geologically, the Kotri city is a flat-topped, typical of arid topography. The climate of city is subtropical, semi-desert type; characterized by low relative humidity, high erratic rainfall, and high rate of temperature. The Industrial zone of Kotri (SITE Kotri) was chose for this study and is located on the right bank of the Indus River (in, Sindh Pakistan). The SITE Kotri ranks third in Sindh province and seventh in the national level. It lies in latitude 25°37'39" north and longitude 68°30'13" east. The major industries in S.I.T.E Area Kotri are textile in nature, cotton, power plants,

pharmaceutical, and general industries. There are more than 120 industries in Kotri industrial zone but most of them are the textile industries and major productions are cotton, cloths, medicines, piping, power production, and general products. There are many colonies, village's education system in the vicinity of S.I.T.E Area Kotri such as: Bihar Colony, Khursheed Colony, Khuda Ki Basti, Yousaf Baloch Goth, Labor Colony, Degree College Kotri, Government Girls College, Government Boys High School, Government Girls High School and Taluka Hospital Kotri with population of around 0.2 Million. In this work the intensity of noise pollution produced from the industries in S.I.T.E area Kotri, Sindh on the vicinity area were measured and presented, the further work on the basis of such measurements is suggested to examine its adverse effects on the peoples living within the industrial area.

2. Nuisance of Noise Pollution

The World Health Organization (WHO) has worked and formalized seven different classes of adverse effects of noise pollution on people and much of them WHO standards are on community noise. Noise may have induced hearing impairment accompanied with distortion, loudness perception and tinnitus, while tinnitus is sometime temporary but if there will be prolonged exposure it becomes permanent[7]. But ultimate results of hearing loss are depression, loneliness, impaired job performance, impaired speech discrimination and sense of isolation [8,9,10]. In urban areas of Pakistan, noise is one of the main pollutant and depending upon the exposure, quality and level of noise, it may harmfully effect on human health due to short term exposure with high level or continuous exposure to less level of noise pollution [11]. The exposure (temporary / permanent) of noise may result in lack of efficiency, impairment of hearing & feeling annoyance and reduction of output of work etc, as the researches on the noisy environment in the industries resulting heart disease, headache, nervous, respiratory problems, irritation, speech interference and many other physiological and psychological problems to the workers [12]. Both, noise induced hearing loss and occupational noise exposure are linked with safety of industrial daily life as it is mentioned that daily doses of noise exposures exceed to 90 dB (A) in industry is more dangerous for those who are suffering from mild noise induced hearing loss [13] and mainly the adverse effects caused by noise pollution are shown in figure 1:

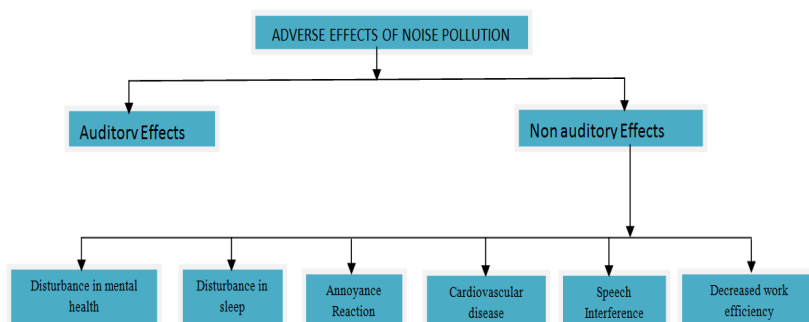


Fig. 1. Adverse Effects of Noise Pollution

3. USA Environmental Quality Standards of Noise

In US absolute criteria for noise exposure to a community do not exist, instead there are guidelines (USEPA 1974) published by US Environment Protection Agency in 1974 as follow up the Noise control act of 1972 as follow: [14].

Table 1. USA Environmental Quality Standards of Noise

S.No:	Area	Measure dB (A)	Indoor		Outdoor	
			Activity Influence	Hearing Loss Contribution	Activity Influence	Hearing Loss Contribution
1	Residential	L_{dn}^*	45	-	55	-
2	Hospital	$L_{eq} (24)^{**}$	-	70	-	70
3	Educational	$L_{eq} (24)^{**}$	45	70	55	70
4	Commercial / Traffic	$L_{eq} (24)^{**}$	-	70	-	70
5	Industrial Recreational Area	$L_{eq} (24)^{**}$	-	70	-	70
6	Farmaland / General unpopulated land	$L_{eq} (24)^{**}$	-	-	-	70

L_{dn}^* It is day-night average sound level

$L_{eq}(24)**$ It is 24 hour equivalent or average A-weighted sound level

4. Noise Standards in Pakistan

The Pakistan Environmental Protection Council (PEPC) constituted a committee in 1995, and proposed National Standard on Noise and forwarded to the Expert Advisory Committee on NEQS consultation for vetting and approval. The following were the proposed standards for noise pollution [15].

Table 3. Noise Standards in Pakistan

S. No	Category of Area	Started up to 30th June 1997 Limits in dB (A)		Started up to 30th June 1997 Limits in dB (A)	
		Day Time	Night Time	Day Time	Night Time
(A)	Residential Area	55-60	45-50	55	45
(B)	Commercial Area	65-70	55-60	65	55
(C)	Industrial Area	75-80	70-75	75	70
(D)	Silence Zone	50-55	40-45	50	40

5. Pollution Measuring Equipment

In this research a sound level meter was used within the vicinity of the industries to check the intensity of noise pollution, the sound level meter is the combination of a microphone and an electronic circuit including amplifier, attenuator, filters and a display unit while on working mechanism it converts the sound signal to an equivalent electrical signal which passed through a weighting network to further conversion for displaying sound pressure level in dB [16 & 17].



Fig. 2. Sound Level Meter set

6. Results and Discussion

The latest and calibrated equipment were used for data collection on the different dates and different timing in the Kotri SITE area, several locations were selected for data collection in different hours of the day. Readings are taken at different locations varying in terms of types of the industry and time with respect to noise pollution and operational hour in the study area.

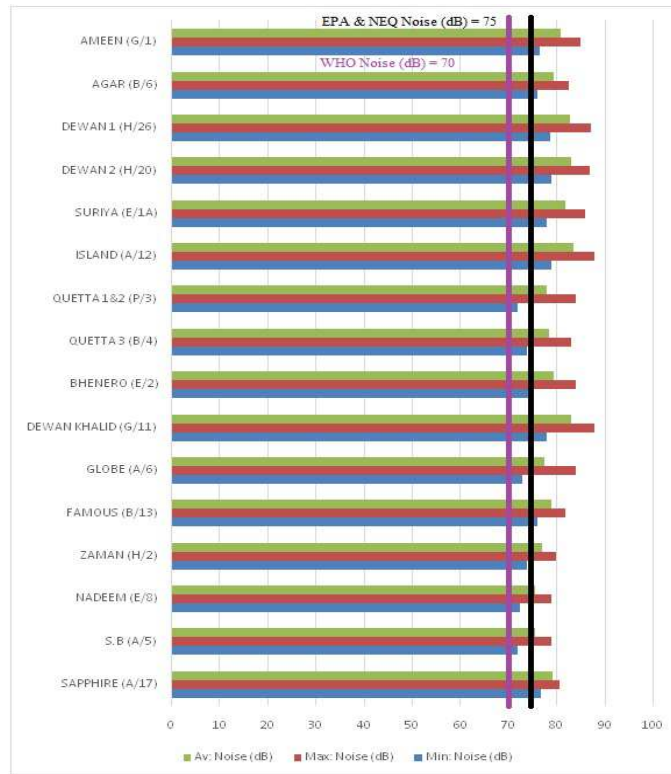


Fig. 3. Comparison of Noise Emission of Textile Industries of SITE Kotri with One Hour Standard EPA, NEQs & WHO

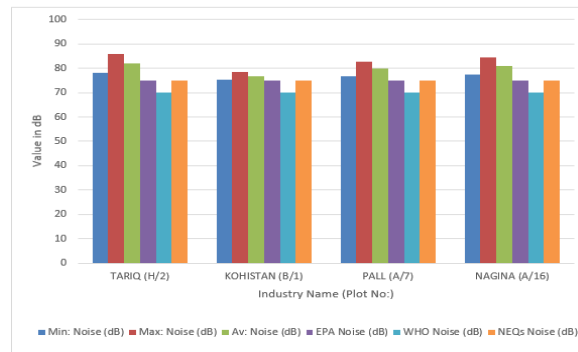


Fig. 4. Comparison of Noise Emission of Cotton Industries of SITE Kotri with One Hour Standard EPA, NEQs & WHO

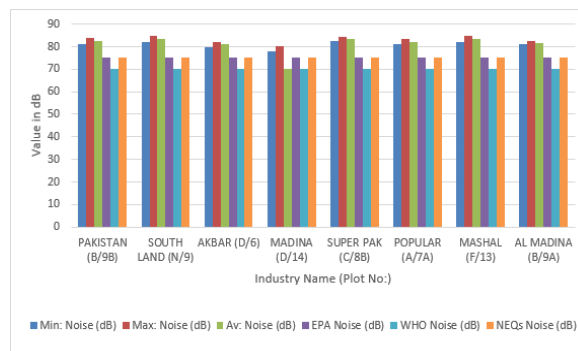


Fig. 5. Comparison of Noise Emission of Flour Mills Industries of SITE Kotri with One Hour Standard EPA, NEQs & WHO

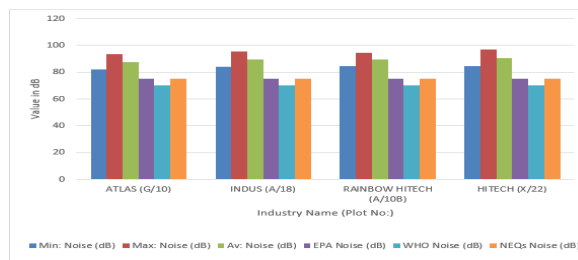


Fig. 6. Comparison of Noise Emission of Piping Industries of SITE Kotri with One Hour Standard EPA, NEQs & WHO

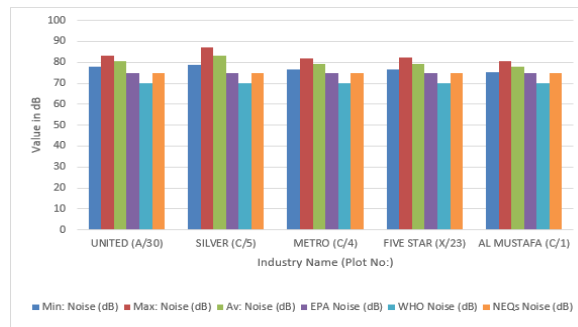


Fig. 7. Comparison of Noise Emission of Rice Mill of SITE Kotri with One Hour Standard EPA, NEQs & WHO

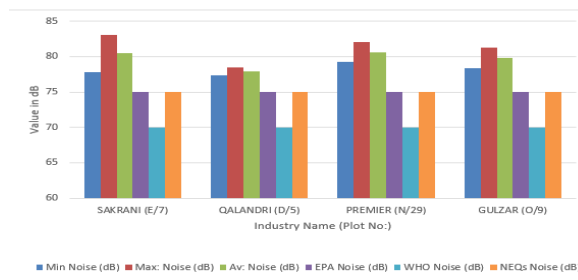


Fig. 8. Comparison of Noise Emission of Oil Industries of SITE Kotri with One Hour Standard EPA, NEQs & WHO

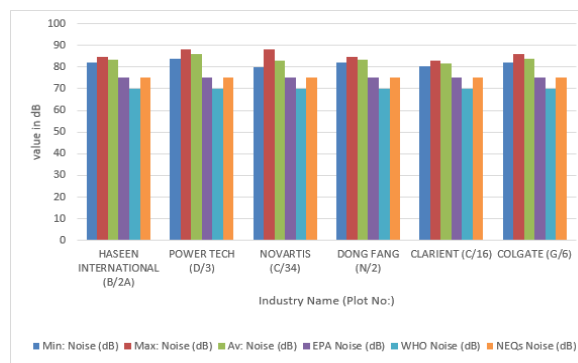


Fig. 9. Comparison of Noise Emission of Other Industries of SITE Kotri with One Hour Standard EPA, NEQs & WHO

Most of the textile industries were running around the clock (24 hrs) and in order to avoid the problems, due to power outage, industries installed their own power generation units and also the other types of heavy machinery for processing the products in every type of industry which was the major sources of producing the noise pollution in the SITE area Kotri, mainly of those were: blowers, exhaust fans, heavy engines, metallic contact process, cams and bearings and many more. The obtained values showed that the textile, cotton, piping industries and rice mills have their average values of noise more than the standard values of the EPA, WHO and NEQs as shown in Figure 3 to

Figure 9. The reason for that the noise from heavy machineries, non-ecological manufacturing process, reflection of noise from other metallic parts, improper usage of lubricants in the machineries and speed up of the machines to fast the production process. The installed exhaust fans were used to move a large volume of air for ventilation, by bringing in fresh air from the outside, blowing out dust, vapor or oil mist from the industries, and for a drying or cooling operation, etc. while the rice mills and piping industries requires heavy metallic machines to process their products, therefore; a large amount of noise was observed in the vicinity of these industries also. But main disadvantage mostly found in all the industries of SITE area Kotri that none has installed sound absorbing mechanism in their vicinities which also lead to produce noise pollution in the vicinity of them. Most of these industries have less maintained machineries and conventional technologies for their manufacturing of the product and that also cause to contribute some level in the noise pollution.

7. Conclusion

Industries contributes many kinds of hazardous pollutants to the environment and produced both traditional pollutants: sulfur dioxide, particulates nutrients and many other organic substances [18], these pollutants are in solid, water and gas forms that can cause serious damage to the bio-systems [19]. The current industrial activities causing the environmental deprivation which becoming one of the major issue for the health of society [20]. Currently, it is good opportunity for those industries to reduce cost, risk and liability and improve efficiency by incorporate the concept of pollution prevention and creating environment friendly and eco-friendly manufacturing processes [21]. Pakistan, during the last few decade, has seen an extensive escalation in population growth, industrialization & urbanization and also with a rapid growth in motorization and energy use, and consequently, a significant increment has been started in the various types and number of emission sources of various noise pollutants [22] and [23]. However, due to the absence of noise quality management proficiencies, the country is suffering from deterioration of noise quality. Evidence from various governmental organizations and international bodies has indicated that both pollutions are significant risk to the environment, health of the population and quality of life [24].

This study was focused on the noise pollution in the SITE area Kotri, the calibrated instruments from the PCSIR Hyderabad were used for data collection at the study area. The collected data was compared with the three different standard agencies at national and international level and from the collected data it may be concluded that all the industries producing the noise level more than the standard values given by international & national agencies. All kinds of pollution, witnessed in Sindh, are also common in many other parts of Sindh- Pakistan [25]. Suggestions for remedies for this nuisance are well spread in the international literature. The industrial cities of Sindh such as Karachi, Hyderabad, Nori Abad, Kotri and Sukkur, which are polluted to various degrees of deleterious elements, are of particular interest, it is pertinent to keep those free from noise and other harmful pollutants. On the basis of this study the authors concluded that whole industries in the SITE area Kotri producing the noise pollution in the vicinity area of the industries specially the textile, cotton, flour and rice mills producing higher values then the standard values described by various agencies at national and international level.

The current state of noise pollution calls for immediate action to tackle the poor noise quality. The establishment of noise standards, an extension of the continuous monitoring sites, and the development of emission control strategies are essential.

8. Recommendations / Mitigation

- It is recommended that in order to circumvent some of the environmental concerns, efforts must be made to legislate and implement regulations in this context. However, in adverse conditions, the latest National Standards of Pakistan Environmental Protection Agency should be followed. But, in the absence of specific standards in this regard, the guidelines of World Health Organization, and/or United States Environmental Protection Agency should be consulted for further guidance.
- Noise barriers must be implanted in the industries to reduce the noise level.
- There should be proper lubrication of the machine to reduce the noise intensity and this will increase the efficiency and life of the machine.

- Soft and spongy material can be used on the walls, floors and ceiling of the working area to reduce reverberation of the noise.
- There should be proper maintenance of exhaust fans and ventilators to reduce the noise intensity in the vicinity of industry.
- In order to reduce noise impact in the vicinity of industrial area, the working shift hours may be reduced, this will also cause to reduce noise exposure time of workers and save their losses.
- It is recommended that plantation of trees, bushes and gardens at the inside and outside of the industries at SITE area Kotri, as plants work as a pollution absorbent [26].

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10. References

- [1]. Muhammad Rizwan , Zubair Ahmed, Waqas Arain and Waqas Ali. Impact of Air and Noise Pollution from the Industries S.I.T.E Area Kotri. Undergraduate Thesis, MUET SZAB Campus Khairpur Mir's, (2014).
- [2]. Klaboe, R., Engelen, E., Steines, M. Context sensitive noise impact mapping. *Appl. Acoust.* 67, 620, (2006).
- [3]. Abbasi, A.A., Marri, H.B. and Nebhwani, M. Industrial noise pollution and its impacts on workers in the textile industries: An empirical study. *Mehran University Research Journal of Engineering & Technology*, Vol. 30 (1), pp. 35-44, (2010).
- [4]. Nesimi Ozkurt, Samet Feyyaz Hamamci, Deniz Sari. Estimation of airport noise impacts on public health. A case study of Izmir Adnan Menderes Airport. *Transportation Research Part D* 36, 152–159, (2015).
- [5]. Aybike Ongel, Fatih Sezgin. Assessing the effects of noise abatement measures on health risks: A case study in Istanbul. *Environmental Impact Assessment Review* 56, 180–187, (2016).
- [6]. Abbasi, A.A., "Industrial Noise Pollution and its Impacts in Textile Based Cottage Industries Tando Adam" M.E Thesis, Institute of Environmental Engineering and Management, Mehran University of Engineering & Technology, Jamshoro, Pakistan, 2008.
- [7]. Berglund B, Lindvall T. (eds.) *Community Noise*. Archives of the Centre for Sensory Research. 1995; 2:1-195. This document is an updated version of the document published by the World Health Organization in 1995. Available at: <http://www.who.int/docstore/peh/noise/guidelines2.html>. Accessed January 6, 2007.
- [8]. Suter AH. *Noise and its Effects*. Administrative Conference of the United States, 1991. Available at: <http://www.nonoise.org/library/suter/suter.htm>. Accessed October 10, 2006.
- [9]. Brookhouser PE. Sensorineural hearing loss in children. *Pediatr Clin North Am* 1996; 43:1195-1216.
- [10]. *Healthy People 2000: National Health Promotion and Disease Prevention Objectives*. U.S. Department of Health and Human Services. Public Health Service. Washington, DC, 1990.
- [11]. Syed Ali Raza, Muhammad Shahbaz, Duc Khuong Nguyen. Energy conservation policies, growth and trade performance: Evidence of feedback hypothesis in Pakistan. *Energy Policy* 80, 1–10, (2015).
- [12]. Memon, M.A. *Road Traffic Noise and its Remedial Measures in Urban Areas of Hyderabad City*, M.E. Thesis, Institute of Environmental Engineering & Management, Mehran University of Engineering & Technology, Jamshoro, Pakistan, (2006).

- [13]. Michel, P., André, G.S., Marc, S., Richard, L., Tony, L., and Fernand, T. Association of Work-Related Accidents with Noise Exposure in the Workplace and Noise-Induced Hearing Loss Based on the Experience of Some 240,000 Person-Years of Observation. *Journal of Accident analysis & Prevention*, Volume 40, No. 5, pp. 1644-1652, 2008.
- [14]. USA Environmental Quality Standards of Noise. US Environment Protection Agency in 1974.
- [15]. Noise Standards in Pakistan. Pakistan Environmental Protection Council (PEPC) 1995.
- [16]. Abolade and Adeboyejo, A.T. Contributions of Urban Informal Enterprises to Noise Pollution in Ibadan, Nigeria. *British Journal of Arts and Social Sciences* ISSN: 2046-9578, Vol.14 No II, (2013).
- [17]. KunalPatel , Jay Patel and Priya Patel. Impact of noise on human and its control measures. *International Journal of Engineering Science & Advanced Technology*. Volume-3, Issue-4, 148-154. ISSN: 2250-3676, (2013).
- [18]. Hunashal, Rajiv B. & Patil, Yogesh B. Environmental noise pollution in Kolhapur city, Maharashtra, India. *Nature Environment & Pollution Technology*, 10(1), 39-44, (2011).
- [19]. Ni, M., Huang, J., Lu, S., Li, X., Yan, J., Cen, K. A review on black carbon emissions, worldwide and in China. *Chemosphere* 107, 83–93, 2014.
- [20]. Murillo-Luna, J.L., Garcés-Ayerbe, C., Rivera-Torres, P. Barriers to the adoption of proactive environmental strategies. *Journal of Cleaner Production* 19, 1417-1425, 2011.
- [21]. Moss, L.R. Local governments reduce costs through pollution prevention. *Journal of Cleaner Production* 16, 704-708, 2008.
- [22]. Khan, M. W., Memon, M. A., Khan, M. N. and Khan M. A. Traffic noise pollution in Karachi. *Pakistan Journal of Liaquat University of Medical & Health Sciences*, Vol. 9(3), pp. 114-120, (2010).
- [23]. Memon, M.A, "Road Traffic Noise and its Remedial Measures in Urban Areas of Hyderabad City", M.E. Thesis, Institute of Environmental Engineering & Management, Mehran University of Engineering & Technology, Jamshoro, Pakistan, 2006.
- [24]. Kazi, A. A review of the assessment and mitigation of Floods in Sindh, Pakistan. *Natural Hazards*, Vol. 7(1), pp. 839-864, (2014).
- [25]. PEPA Position Paper for Environmental Quality Standards of Noise in Pakistan. Pakistan Environmental Protection Agency, Islamabad, Pakistan, (2013).
- [26]. Licitra, G., Gagliardi, P., Fredianelli, L., Simonetti, D. Noise mitigation action plan of Pisa civil and military airport and its effects on people exposure. *Appl. Acoust.* 84, 25–36, 2014.