engineering proceedings

MDPI

Proceeding Paper

Vehicle Traffic as a Source of CO_2, CO, HC and Particulate Polycyclic Aromatic Hydrocarbon in the Mingora City, District Swat, KP, Pakistan and Their Effect on Health, Temperature and Tourism †

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† Presented at the 1st International Conference on Energy, Power and Environment, Gujrat, Pakistan, 11–12 November 2021.

Abstract: In this work we collected a large number of vehicular emission data of carbon dioxide (CO_2), carbon monoxide (CO) and hydrocarbons (HC) from custom paid and non-custom paid vehicles in the Swat district, which are responsible for changing the climate and global warming. Swat valley is facing severe threats and impacts of the climate change as there is a record high increase in the temperature with flash floods and droughts becoming increasingly common. The main cause of the increasing warm weather is vehicle emissions along with the cutting of forest on a large scale in the valley. Hospital records for 2768 children aged 0 to 18 years (697 of whom had two encounters) were obtained for a main city area of two hospitals in Saidu Sharif, Swat. Residential addresses were geocoded. A line source dispersion model was used to estimate individual seasonal exposures to local traffic-generated pollutants (nitrogen oxides, carbon monoxide and hydroxide).

Keywords: Swat; vehicle; air pollution; health; tourism and temperature

Citation: Sayed, M.G.; Ullah, N.; Khalid, S.; Mabood, F.; Umar, M.N. Vehicle Traffic as a Source of CO_2, CO, HC and Particulate Polycyclic Aromatic Hydrocarbon in the Mingora City, District Swat, KP, Pakistan and Their Effect on Health, Temperature and Tourism. *Eng. Proc.* **2021**, *12*, 32. https://doi.org/10.3390/engproc2021012032

Academic Editor: Muhammad Tanveer

Published: 24 December 2021

1. Introduction

Air is a mixture of nitrogen (78%), oxygen (21%), water vapor (variable), argon (0.9%), carbon dioxide (0.04%), and many trace gases. Air is contaminated by dust, pollen, spores and other impurities such as nitrogen dioxide (NO_2), nitric oxide (NO), sulfur dioxide (SO_2), ozone (O_3), and carbon monoxide (CO). Vehicle emissions are considered one of the main sources of CO, CO_2 and HCs [1]. Air pollution is the major cause of respiratory infection, lung cancer, heart diseases, asthma, diabetes, cardiovascular diseases, skin diseases and pulmonary diseases [2]. Presently, Swat valley is facing severe threats and impacts of climate change as there is a record high increase in the temperature with flash floods and droughts becoming increasingly common. The main cause of the increasing warm weather is the vehicle emissions. Environmental experts have stressed the need for controlling the increasing vehicular emissions and the rapid increase in illegal and NCP vehicles in the region for a pollution-free environment [3,4].

2. Materials and Methods

2.1. The Area under Investigation

Swat District is the 15th largest district of Khyber Pakhtunkhwa province. Swat District is centered on the valley of Swat, which is a natural geographic region surrounding the Swat River. Swat District is subject to cold, snowy winters of 105 °F (41 °C), although the lower plains experience occasional snow. Both regions are subject to two monsoon

seasons—one in winter and the other in summer. The lower reaches of Swat have vegetation characterized by dry bush and deciduous trees, while the upper reaches of the district have thick pine forests [5]. In 2015–2016, VITS monitored 14,000 vehicles in Mingora following National Environmental Quality Standards (NEQS) and issued pass certificates and stickers to 10,000 vehicles, while 4000 vehicles that failed the NEQS protocols were fined according to the traffic laws. According to 2016 exposure of 4.4ppm monoxide (CO), 14.3 ppm Sulphur dioxide (SO_2), 8.4 ppm nitrogen dioxide (NO_2) and 128 micro gram/m^3 total suspended particles (TSP) were measured in Mingora, which all affect human health badly [6].

2.2. Methodology

A gasses analyzer was used to determine the emission value of CO, CO_2 and HCs from vehicles (Table 1). It has two main parts, a gasses analyzer and smoke sensor. Analyzer is connected to the computer and smoke sensor is attached with an analyzer. During analysis of emission from vehicles, the smoke sensor is connected to the silencer. The smokes from vehicles go to the gasses analyzer through the smoke sensor's pipes for the analysis and diagnoses of the number of gasses and then the amount of CO, CO_2, and HCs are shown as a result on the screen of the computer.

Table 1. Effect of NOx CO on humane health.

Model	Patients, No	Exposure	HR (95% Cl)	*p* Value	Product Term
Male	1599	NOx	1.0719 (0.991–1.158)	0.08	0.30
		CO	1.0549 (0.978–1.137)	0.17	0.45
Female	1169	NOx	1.136 (1.043–1.238)	0.6	Reference
		CO	1.100 (1.011–1.197)		Reference
Age group, y					
0	508	NOx	1.197 (1.075–1.333)	0.02	0.22
		CO	1.158 (1.041–1.289)	0.007	0.32
1–5	1158	NOx	1.042 (0.952–1.140)	0.18	0.52
		CO		0.65	0.44
6–18	1102	NOx	1.090 (0.979–1.212)	0.12	Reference
		CO	1.076 (0.972–1.191)	0.16	Reference

3. Result and Discussion

There are more than sixty thousand vehicles including from motorbikes, trucks and pickups registered to date. Ironically, there are over 12,000 illegal auto-rickshaws playing on Swat roads; according to the latest available data in the DPO Swat office, a total of 60,000 NCP vehicles move in Swat, and the total number of NCP and illegal vehicles in Swat stands at 114,226. According to the findings of this study, air pollutants in Swat have greater concentrations of components that represent the contribution of automobile emissions of CO_2, CO, and hydrocarbons [7,8].

The findings show that, on average, climate conditions and air pollution have an impact on the tourism sector and the health of Swat people [9]. There were 2071 children (74.8%) with 1 hospital encounter during follow-up and 697 (25.2%) with 2 or more (Table 2). There was an expected predominance of boys, and 1666 children (60.2%) were 0 to 5 years old at their first hospital encounter and 66.7% had readmissions. Seasonal air pollutant exposures are given in Table 1. Pollutants were strongly correlated (*R*_0.9). The modelled concentrations of fresh traffic emissions equalled approximately 20% of ambient NOx concentrations at the regional station (38 ppb). Other pollutants (CO and NO_2) shared a similar pattern. Nevertheless, fresh traffic-generated air pollution contributes greatly to the spatial heterogeneity of ambient pollution.

Table 2. Vehicle emission data.

S. No	Vehicle No	Model	Company	CO%	HC ppm	CO_2%
1	RIS 6611	2004	Toyota	0.74	163	12.34
2	LES29	2007	Toyota	3.85	199	12.80
3	GLT3250	2000	Toyota	4.2	389	9.3
	Emission from petrol and CNG vehicle engines (1800 cc)					
1	LED 8573	2008	Premio	3.84	324	7.62
2	D2525	2017	XIi	2.63	384	11.6
3	LHR 2162	2006	Premio	3.46	346	8.64
	Emission from petrol and CNG vehicle engines (1600 cc)					
1	AB 4657	2005	Toyota	2.55	230	5.10
2	C4426	1986	Toyota	3.16	155	11.25
3	AJ 8086	1994	Toyota	4.08	226	13.40
	Emission from petrol and CNG vehicle engines (1500 cc)					
1	B 2434	1994	Toyota	2.13	284	7.3
2	AG 7276	1994	Toyota	7.04	231	6.41
3	LEJ 1859	2007	Xli	3.93	362	12.41
	Emission from petrol and CNG vehicle engines (1300 cc)					
1	AM 8632	2005	Toyota	0.45	37	15.30
2	AK 4630	2003	Toyota	2.45	317	9.8
3	AB 2123	2004	Toyota	0.97	99	9.41
	Emission from petrol and CNG vehicle engines (1000 cc)					
1	PSR 0727	1996	Suzuki/Swift	0.33	151	5.45
2	AB 2063	2001	Toyota	1.88	285	10.8
3	AK 3624	2002	Toyota	1.85	179	13.80
	Emission from petrol and CNG vehicle engines (800 cc)					
1	LHR 2391	1996	Suzuki	2.38	255	5.32
2	B3657	1988	Suzuki	1.83	236	8.34
3	LEJ2134	1992	Suzuki	2.71	267	8.3

4. Conclusions

The atmosphere of Swat valley, particularly Mingora city, is polluted day by day due to the increasing number of vehicles, mostly Non-Custom Paid (NCP) vehicles. Approximately, the number of HCs released by the total of 60,000 vehicles on average is 347.8, in percent this is 0.5796% and in total is 20,868,000 ppm; the amount of CO released in percent is 3.0107% and in total is 1806.42 ppm, while the amount of released CO_2 in percent is 9.765% and in total is 5859 ppm per day in Mingora city only, owing to which the temperature of the city increased as compared to other parts of Swat. These pollutants, traffic-related NOx and CO and hydrocarbons were associated with repeated hospital encounters for asthma in children (Table 1), suggesting that traffic-generated air pollution in Swat affects asthma symptom severity.

References

1. Hamanaka, R.B.; Mutlu, G.M. Particulate Matter Air Pollution: Effects on the Cardiovascular System. *Front. Endocrinol.* **2018**, *9*, 680. [CrossRef] [PubMed]
2. Anderson, H.R.; de Leon, A.P.; Bland, J.M.; Bower, J.S.; Strachan, D.P. Air pollution and daily mortality in London: 1987–92. *BMJ* **1996**, *312*, 665–669. [CrossRef] [PubMed]
3. Laurance, W.F.; Goosem, M.; Laurance, S. Impacts of roads and linear clearings on tropical forests. *Trends Ecol. Evol.* **2009**, *24*, 659–669. [CrossRef] [PubMed]
4. Khan, S.; Qureshi, S.F.; Hasan, M.-U. Climate change and hazards risk management, community capability, resilience and vulnerability in Swat, Shangla, and Kohistan District, Northwest Pakistan. *Int. J. Econ. Environ. Geol.* **2019**, *10*, 69–77.
5. Bacha, M.; Muhammad, M.; Kılıç, Z.; Nafees, M. The Dynamics of Public Perceptions and Climate Change in Swat Valley, Khyber Pakhtunkhwa, Pakistan. *Sustainbility* **2021**, *13*, 4464. [CrossRef]

6. Mashauria, D.A.; Bukirwaa, F.; Banaddab, N.; Walic, U.G.; Nhapi, I. Development of best management practices for controlling the non-point sources of pollution around Lake Victoria using SWAT Model: A Case of Simiyu catchment Tanzania. *Open Environ. Eng. J.* **2012**, *5*, 77–83.
7. Kaur, S.; Nieuwenhuijsen, M.; Colvile, R. Fine particulate matter and carbon monoxide exposure concentrations in urban street transport microenvironments. *Atmos. Environ.* **2007**, *41*, 4781–4810. [CrossRef]
8. Nafees, M.; Khan, S.Z.; Sifatullah, S.; Rowaidullah, N. Study of vehicular emissions with reference to Pakistan's National Environmental Quality Standards: Case study of District Swat, North of Pakistan. *Interdiscip. Environ. Rev.* **2013**, *14*, 86–96. [CrossRef]
9. Komolafe, A.A.; Adegboyega, S.A.-A.; Anifowose, A.Y.; Akinluyi, F.O.; Awoniran, D.R. Air pollution and climate change in lagos, nigeria: Needs for proactive approaches to risk management and adaptation. *Am. J. Environ. Sci.* **2014**, *10*, 412. [CrossRef]