MERIT RESEARCH JOURNALS
www.meritresearchjournals.org

Merit Research Journal of Medicine and Medical Sciences (ISSN: 2354-323X) Vol. 3(8) pp. 376-380, August, 2015
Available online http://www.meritresearchjournals.org/mms/index.htm

Original Research Article

Air pollution concerns at *Quba* district in *Al-Madina Al-Munawara*, KSA

Ayoub A. Bazzaz

Department of Biology, Faculty of Science, University of Kirkuk, Sayyada, Kirkuk, Iraq

Email: ayoubbazzaz@yahoo.co.uk

Abstract

Using highly sensitive air pollution detecting equipments ITX, ATX620 and IBRID-MX6 for over 12 months (*June 13th 2010-June 3rd 2011*) at *Quba* Street of Al-Madina Al-Munawara, the air pollution has promptly been measured. Air pollution, in general, had reached the peak between 07:30-08:30am and 12:00-13:00pm for 6 working days per week. The peak for carbon monoxide (CO) recorded (75 ppm) between 08:00-11:00pm for 5 months a year i.e. *Rajab, Shaban, Ramadan, Thul-kuada* and *Thul-Hujja* months of the Islamic calendar*, consecutively*. Similarly, CO had risen during the praying rush hours of late prayers (*Taraweeh*) in the holy month of *Ramadan* (*August 2010*) too. Such a high record of CO is above the national standard limits which alert high risk of health. Other air pollutants i.e. NO_x and SO_x showed lower records than the CO. The overall percentage of smoking cars was almost 5%. It was concluded that the dramatic rise in the CO levels was due to the vast increase of the vehicles using this road, arbitrary parking on both sides and overuse of private vehicles by public. Such status of air pollution at *Quba Street* does alert the public awareness and the necessity to remedy the risk of CO on the human health.

Keywords: Air pollution, CO, Health risk, Quba, KSA.

INTRODUCTION

Over the last four decades there has been an increasing global concern over the public health impacts attributed to the environmental pollution causing a wide-reaching problem. Its impact on health of human populations is enormous according to the National Ambient Air Quality Standards (NAAQS). The majority of the population is exposed to low ambient concentration of Carbon Monoxide (CO) resulting in an average blood level concentration of carboxyhemoglobin of less than 2% (Engineering Tool Box. Exposure health effects of Carbon Monoxide – CO, 2013). However in many American cities, high short-term peak of CO concentrations (mean 50 ppm) occur in heavy traffic areas (Morris et al., 1995; Maynard and Waller, 1999; Morris, 2000; Fierro et al., 2001). Exposure to these ambient CO levels may affect groups of people who work on the streets such as bus and truck drivers, police officers, vehicle inspectors, street repair workers, street cleaners, street vendors, parking attendants, pedestrians, and cyclists (Schell et al., 2006; Kimani, 2007). It also has adverse effects on dual-task performance in human (Putz, 1979) and memory disturbance following low level exposure to CO (Ryan, 1990). Vehicle drivers as well as any carried passengers are also exposed to CO from traffic and leakage of their own vehicle's exhaust (Maynard and Waller, 1999; Fierro et al., 2001; Godin et al., 1972; World Health Organization [WHO], 1999; Von Burg, 1999).

The main causes for air pollution in KSA are due to the rapid growth in urban population, increasing industrialization, improvement in the quality of the life and rising demands for energy and motor vehicles (Bazzaz

Table 1. Number of vehicles counted automatically through 12 months (Rajab 1431H-Jumadi-II 1432H) which correspond to (13th June 2010 – 2nd July 2011) including petrol, diesel as well as the smoking vehicles passing through 400 meter length *Quba Street* and their percentages to the total vehicles.

Hijri year	Rajab (1431)H	Shaaban (1431)H	Ramadan (1431)H	Shawal (1431)H	Thulkuda (1431)H	Thulhuja (1431)H	Muharam (1432)H	Safar (1432)H	Rabee-I (1432)H	Rabee-II (4132)H	Jumadi-I (1432)H	Jumadi-II (1432)
Christian year	13/6/2010 12/7/2010	13/7/2010 11/8/2010	12/8/2010 09/9/2010	10/9/2010 9/10/2010	11/10/2010 07/11/2010	8/11/2010 6/12/2010	7/12/2010 05/1/2011	06/1/2011 032/2011	04/2/2011 05/3/2011	06/3/2011 04/4/2011	05/4/2011 04/5/2011	05/5/2011 02/6/2011
Total vehicle	16,899	17,705	20,499	22,037	22,582	23,944	22,434	23,720	23,268	23,003	24,224	24,110
Diesel vehicles	2,469	2,170	5,419	2,187	4,781	7,122	3,487	2,734	2,953	1,971	2,415	2,341
Diesel%	14.61	12.25	26.43	9.92	21.17	29.74	15.54	11.52	12.69	8.56	9.96	9.71
Smoking vehicles	842	966	1,434	1,052	1,247	1,198	994	1,023	1,057	1,167	983	927
Smoking vehicles%	4.98	5.45	6.99	4.77	5.52	5.00	4.43	4.31	4.54	5.07	4.04	3.84

and Almanea, 2012). Accordingly, human exposure to pollution is believed to be more intense now than at any other time in human existence (Bazzaz et al., 2011; Almanea, 2011). Within the City of *Al-Madina Al-Munawara* public are more aware of air pollution than its risks (Al-Zahoofy et al., 2010). A recent work revealed the concerns of air pollution around a busiest part of the holy city i.e. the parking of the holy *Mosque* (Bazzaz and Almanea, 2012) while, researches in KSA to determine and assess the air pollution and its consequences are still scanty (Sharaf and Al-Ghamdi, 1995).

The *Quab Street* aligned with 4 lanes is one way road system, whose both sides are, inappropriately used as for casual parking. It is one of the oldest roads ever in *Al-Madinah* which links between two holy *Mosques i.e. Mosque of* Prophet Muhammad and *Quba Mosque,* where the name of the street is driven from. The *Quba Street* does ramify to alongside 420 meters to link to a most overpopulated area as well as to richest roads in trade centre including many private mini-markets and restaurants where downloading and uploading activities are quite often. Such busy road with both vehicle and people attracted our attention in assessing the emitted gases and its expected risks to local commuters, shoppers and pilgrims. The measurements encountered in this research are based on Hijri or *Islamic Calendar* which vary 10-11 less days per year (355 days) in contrast with the Christian year (365 days). Therefore, the conclusion and any other consequence driven are pendant only on *Islamic calendar* rather than the Christian calendar although the latter is included for compatibility purposes. The measuring unit of CO is ppm or parts per million and is defined as the mass of the component in solution divided by the total mass of the solution multiplied by 10^6 (one million).

MATERIALS AND METHODS

Computerized and automatic measuring equipments ITX, ATX620 and IBRID-MX6 were used in *Al-Madina Al-Munawara*, over 12 months duration of the year (*June 13th 2010-June 3rd2011*). They were installed by the traffic light posts alongside the 420 meters length by 20 meter width *Quba* Street. Other equipments were installed to count the number of various vehicles passing through the street over 24 hours per day recording and differentiating between diesel and petrol vehicles as well as identifying the smoking from none-smoking cars. The quality of these vehicles picked up were done using road sensor machine which can easily identify and record the total number of these two types of the vehicles over a fixed period of time. The self-recorded data were collected, analyzed using Student T-Test and tabulated.

RESULTS

The range of vehicle density using *Quba Street* was between 17,000->24,000/month while the highest number had recorded on both *Jumadi-I* and *Jumadi-II* months and the lowest on *Rajab* month. The percentage of Diesel to petrol vehicles using *Quba* Street all over year 1431-1432H has ranged between 8.6-30% while the highest percentage was recorded at both *Ramdan* and *Thul-Huja* months. The percentage of the smoking to none smoking vehicles over all year has ranged between 4-7% (arithmetic mean of 4.9±1.57) with highest at *Ramadan* month (Table 1).

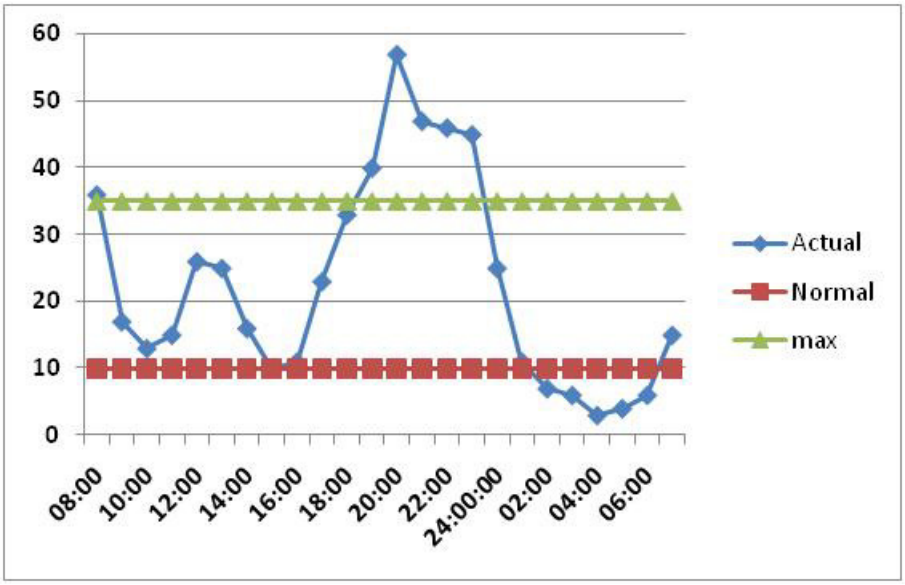

Figure 1. The annual mean CO between 13th June 2010 -3rd June 2011 at *Quba Street*. Y-axis represents ppm and X-axis the daily hours. Note the CO levels have exceeded the maximum allowed standard (35 ppm) around 19:00-23:30 while it recorded a lowest level at 04:00.

Daily concentrations of CO gas ppm reached the peak twice a day (12:00pm and 08:00-09:00am) indicating the rash hours at the area generated from increased vehicles and the consequent congestion. The highest records of CO gas had well exceeded the allowed levels (75 ppm) starting from the *Rajab, Ramadhan, Shaaban, Thikuada and thihujja* months consecutively. However, the CO levels dropped down to the minimum after the midnight to around 04:00 when it started to pick up again. In addition, the CO level went up to 58 ppm again during the praying rush hours of late prays (*Taraweeh*) in holy month *Ramadhan* (*August 2010*) too.

The annual air pollution, in general, around *Quba* Street for Gaseous oxides other than CO i.e. Nitrogen Monoxide (NO), Nitrogen dioxide (NO2) and Sulfate dioxide (SO_2) were below the average the annual CO. The latter levels had elevated to the peak between 07:30-08:30 and 12:00-13:00 of 6 working days around the *holy Mosque*. The daily records of CO concentrations showed pollution up to 75 ppm twice a day i.e. at mid-day (12:00-13:30) for 90 minutes duration and in the early morning (08:30-09:00) but for 30 minutes only. (Figure 1)

DISCUSSION

The city of Al-Madina is the second holy city and one of the busiest Saudi cities in both public and trade. Over 10 million pilgrims from all over the world visit this city a year and shop from. The city is also growing from educational aspect as a second university has also been established a few years ago (Islamic university) which hosts thousands of students from the Islamic countries. Expatriates take medical treatments e.g. vaccination prior landing KSA as a precondition for visiting Saudi cities. The data presented in this research represent air pollutants within Islamic or *Hijri* months of the year (1431/1432H) rather than Christian year (*June 13th 2010-June 3rd June 2011*). The Islamic calendar is almost 10-11 days shorter than the Christian year and therefore, continuously variable. The choice of *Quba Street* was targeted particularly due to its vicinity to the Prophet *Mosque* and is used as a route to *Quba Mosque*, which is a second holy Mosque in *Al-Madina*. Accordingly, the vehicles do not stop in this street round the clock leading to increase the risk of air pollution more than anywhere else in Al-Madina Al-Munawara.

The records of CO levels are above the international standard limits allowable by OSHA in the workplace over an eight hour period is 35 ppm (Engineering Tool Box. Exposure health effects of Carbon Monoxide – CO, Provide year). The elevated CO levels therefore are due the congestion of vehicles within the *Quba* Street leading to consequence delay. The high numbers of vehicle passing through *Quba* Street on daily basis and round the year may indicate an almost heavy use of it as an only main route and a short cut to *Quba Mosque*; accordingly, it seems to be beyond capacity. Such an overuse causes slow traffic flow and congestion almost twice a day particularly from 6:00pm to 01:00am.

Consequently, the concentration of CO raises two folds beyond the allowed standard (World Health Organization [WHO], 1999).

Although other oxides i.e. Nx and SOx had recoded relatively lower percentages in comparison with International standards (Schell et al., 2006) but they could in total cause direct or indirect health hazards to daily commuters, residents and shoppers in the area (Kimani, 2007).

The percentage of vehicles showed an increase during the holy month *Ramadan, Thul-Huja and Thul-Quda* due to the escalated number of road users including visitors and pilgrims to attend the holy mosques. The daily record of CO twice had exceeded above the standard international limits (9-30 ppm) at (12:00-13:30) for 90 minutes duration and in the early morning (08:30-09:00) for 30 minutes. The latter clearly indicates the most polluting daily rush hours where commuters attend the Holy Mosque and when locals go to work and take their children to schools, consecutively.

Vehicle in trade action arbitrary park on both sides of the road do inevitably minimize the capacity of the road by reducing its width leading to further congestion. Cars reversing to come out of side-parks do aggressively reverse can force stop other running cars and cause further delay and occasionally serious road accidents and consequent casualties. Once an accident takes place vehicles do not switch engines off waiting cleared off but rather cause further noise pollution.

Formal records of vehicle density in KSA showed a vast increase of the vehicles (>6 million vehicles on roads) against a total population of 28 million (14 Saudis another 14 expatriates) [over 1:5 car: individuals]. Taking in account only males and youngsters are allowed to drive, this proportion would almost increase to 1:2 car/individual. Additional factors do also efficiently contribute to air pollution i.e. arbitrary and illegal parking, increased proportion of underage drivers, high percentage of unqualified and/or arrogant drivers and the public preference to use their private vehicles unaware of their consequence risk on health (Al-Zahoofy et al., 2010). An overall low percentages of smoking vehicle (<5%) passing through *Quba* Street may represent a positive sign of the good quality cars (>95%) being owned by the Saudis in comparison with other developing countries.

The CO is produced from an incomplete burning of carbon based fuels i.e. smoking or old vehicles. Smoking vehicles can emit more CO and perhaps other toxic gases than non-smoking cars leading to increase in human and animal health risks. The tasteless and odorless characters of CO may further elevate the risk of it to humans. In the Western society it is often called the “Silent Killer” because of its ability to take lives quickly and quietly (Li et al., 2009). Hundreds of lives are claimed each year, and survivors of CO poisoning can be left with psychological and neurological symptoms (Engineering Tool Box. Exposure health effects of Carbon Monoxide – CO, Provide year). Sadly, this toxic gas takes lives that could be saved through education, awareness, and simple protection (Al-Zahoofy et al., 2010).

The mechanism of action of CO involves its ability to deprive the blood stream of oxygen, suffocating its victim [20] and death via exerting its effects on pulmonary tissues (Almanea, 2011) and blood (Al-Zahoofy et al., 2010). Nobody is immuned against CO, though children 14 and under are more likely to sustain poisoning than adults at lower levels. CO can cause immediate health problems, and even death, in high concentrations and it can also cause long-term health problems in low concentrations if a person experiences regular exposure (at home, or in the workplace) and significant exposure to CO can also reduce life expectancy (CO knowledge Centre, 2012; Akland et al., 1985). Mobile Medical patrols and units in Al-Madina do report victims i.e. pilgrims suffering from toxic symptoms of CO i.e. headaches, dizziness, weakness and clumsiness, nausea and vomiting, quick irregular heartbeat, chest pain, hearing loss, blurry vision, disorientation or confusion seizures and often suffocation every year during the holy months. Regular occurrence of any of these symptoms might be an indication of CO poisoning. The health threat from lower levels of CO is most serious for those who suffer from heart disease, like angina, clogged arteries, or congestive heart failure. For a person with heart disease, a single exposure to CO at low levels may cause chest pain and reduce that person’s ability to exercise; repeated exposures may contribute to other cardiovascular effects (www.epa.gov/ttn/oarpg/t1/memoranda/rprtguid.pdf). Wall-socket CO detectors for homes and personal or pocket CO detector are recommended for all the commuters and pilgrims rather than mask filter which is so common by pilgrims during the holy months. Perhaps a better way to stay safe, both at home and away, is with a portable CO monitor that has a digital readout. It allows to monitor levels anywhere in any environment, no matter where or might be. It also provides the ability to routinely test the detector with a small source of CO (Akland et al., 1985).

Exposures in long-term case studies are often of unknown levels and duration. Patients are sometimes exposed to short-term of acute intoxication, in addition to the low level, chronic exposure; thus the difficulty in determining which type of exposure is responsible for any subsequent health problems while some evidence suggests that chronic exposure to CO may produce mild neurological effects (Townsend and Maynard, 2002). Perhaps a future study, using complete blood counting (CBC) technique (Bazzaz and Almanea, 2012) would be necessary to carry out on shopkeepers at *Quba* district who, due do the nature of their job considered to be long-term exposed to CO.

CONCLUSION

The dramatic raise in the CO levels at *Quba Street* in *Al-Madina Al-Munawara* during the holy months does alert the risk of CO pollution to both commuters and pilgrims. Such high risk of air pollution could impose serious precautions and commitments to the Saudi authorities for the future.

REFERENCES

Akland GG, Hartwell TD, Johnson TR, Whitmore RW (1985). Monitoring Human Exposure to Carbon Monoxide in Washington, DC and Denver, Colorado, during the Winter of 1982–1983, *Environmental Science and Technology*, 19(10): 911–918.

Almanea NN (2011). Pulmonar Tissue response in guinea pigs *Cavia porcellus* exposed to diesel exhausted gases (A histological and Histochemical study). MSc thesis, Taibah University, KSA.

Al-Zahoofy N, Al-Muhammadi M, Bazzaz AA (2010). Public self-awareness of Environmental pollutants at Al-madianah Al-Munawara. *International Scientific Conference* (IWAM), Ras Al Khayma, UAE, 21-24th February 2010.

Bazzaz AA, Al-Juhani, AK, Al-Erwi NS, Kurdi, KN (2011). The Air pollution concern within the Holy Prophet Mosque in Al-madinah Al-Munawarah. *Journal of Environmental and Engineering,* 5: 550-556.

Bazzaz AA, Almanea NN (2012). Assessment of the acute effects of DEE (Diesel Exhausted Emitted) on blood parameters in Guinea pigs, *Cavia porcellus*; *J. Env. Scie. Eng.* 5(1): 629-636.

CO knowledge Centre (2012) http://www.detectcarbonmonoxide.com/co-health-risks/

Engineering Tool Box. Exposure health effects of Carbon Monoxide – CO (2013). Also available at: *http://www.engineer ingtoolbox.com /carbon-monoxide-d_893.html*

Fierro MA, O'Rourke MK, Burgess JL (2001). Adverse health effects of exposure to ambient carbon monoxide. *Health Report*. University of Arizona, USA.

Godin G, Wright G, Shephard RJ (1972). Urban Exposure to Carbon Monoxide. Arch Environ Health, 25: 305-313.

http://www.korogocho.org/english/index.php?option=com_docman&task=doc_download&gid=54&Itemid=73

Kimani NG (2007). *Environmental Pollution and Impacts on Public Health: Implications of the Dandora Dumping Site Municipal in Nairobi, Kenya*, UN Environment Programme, pp. 1-31. Also available at:

Li L, Hsu A, Moore PK (2009). "Actions and interactions of nitric oxide, carbon monoxide and hydrogen sulphide in the cardiovascular system and in inflammation—a tale of three gases!". *Pharmacology and therapeutics* 123 (3): 386–400. doi:10.1016/j.pharmthera.2009.05.005. PMID 19486912.

Maynard RL and Waller R (1999). Carbon Monoxide. In: Holgate ST, Samet JM, Koren HS & Maynard RL (eds) Air Pollution and Health Academis Press: Harcourt Brace & Company, London, UK; Publishers, pp. 749-796.

Morris RD (2000). Low-level carbon monoxide and human health. In: Penney DG, ed. (1995) *Carbon monoxide toxicity.* London: CRC Press: 381–391.

Morris RD, Naumova EN, Munasinghe RL (1995). Ambient air pollution for congestive heart failure among elderly people in seven large US cities. *Am J Public Health*; 85:1361-1365.

National Ambient Air Quality Standards (NAAQS) (2012). USA Environmental Protection Agency. Also available at: http://www.epa.gov/air/criteria.html.

Putz VR. (1979). The effects of carbon monoxide on dual-task performance. *Human Factors;* 21: 13–24.

Ryan CM (1990). Memory disturbances following chronic, low-level carbon monoxide exposure. *Arch Clin Neuropsychol; 5*: *59*–67.

Schell LM, Gallo MV, Denham M, Ravenscroft J (2006). Effects of Pollution on Human Growth and Development: An Introduction, *J. Physiol. Anthropol.* 25(1): 103-112.

Sharaf EA, Al-Ghamdi AS (1995). Analysis of injuries resulting from traffic accidents in Riyadh area, in: The 4th Saudi Engineering Conference.

Toole and Toole (1995) “Understanding Biology” for Advanced A-Level; 3rd Ed.Stanley Thomas Publisher, Oxford, UK.

Townsend CL, Maynard RL (2002). Effects on health of prolonged exposure to low concentrations of carbon monoxide. *Occup Environ Med;* 59: 708-711. *doi:10.1136/oem.59.10.708*

Von Burg R (1999). Toxicology Update. *J Applied Toxicol*, 19: 379-386.

World Health Organization [WHO] (1999). Carbon Monoxide. In Environmental Health Criteria 213. Geneva: 2nd Edn. Finland.

www.epa.gov/ttn/oarpg/t1/memoranda/rprtguid.pdf.