

## Comparison of the Noise Pollution in Sulaimani City between the Years 2009 and 2014

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### Abstract

The noise pollution has been studied at three different locations in June, 2014 in Sulaimani city/Kurdistan region. The data has been compared with the previous data which has taken in June, 2009. In the result, a remarkable reduction in noise has been observed which confirm the effective improve of managing the city and increasing the public knowledge. This improvement is very important because it has a direct effect on the health of the citizens.

**Keywords:** Noise pollution; Sulaimani/Kurdistan

### Introduction

Noise pollution has received significant attention over the past years from both the scientific and environmental risk management communities in Kurdistan and internationally [1-4]. The main reason for this attention is the scientific literature, indicating the extensive impact exerted by these pollutants on human health [5].

Fast urbanization, concentrated life style and automation have caused the polluted sound, air, space, land and water. These unwanted results have led to emergence the new branches of science in the world. Therefore, the awareness of Noise pollution and measures to monitor and control sound quality are important to indicate the pollution levels [6].

Urban sound pollution is the most important population health risk factor that can be significantly reduced by changing the personal behavior, life style, improving the city's management and controlling the quality of the automobiles [7].

Sulaimani is a city in Kurdistan of Iraq which rapidly grow to become a big urban. Study of Noise in this city is new, and only a few researches have been done in this field to measure the noise pollution. Recent studies by Parekhan et al. [8] that represents noise pollution in six different points in Sulaimani city [8], reveal that the noise level in all locations exceeded the prescribed limit average of noise in the center of Sulaimani is between 60 dB and 80 dB with some pulses of more than 95 dB. Similarly, another work is conducted for measuring noise in the old campus of university of Sulaimani [9].

In this study, the noise level has been measured in three different locations at the center of Sulaimani city and compared with the previous noise level that has been taken at the same location in June 2009.

### Noise Measuring

To measure and control the noise, we first need to know that both sound and noise have wave behavior and categorized in a mechanical waves. Every mechanical wave has frequency, amplitude and wave length. Therefore, the effect of noise depends on intensity of the wave and its frequency [10]. The most common approach to measure the intensity of sound is dB (decibel) that can be defined by:

$$I(\text{dB}) = 10 \log(I/I_0)$$

Where I is intensity of measured sound and  $I_0$  is threshold intensity of sound.

The sound intensity is logarithmic; increasing each 10 decibels

represents a tenfold increase in noise intensity. 80 dB is 1 million times more intense than 20 dB. Furthermore, distance diminishes the effective decibel level reaching the ear. Thus, moderate auto traffic at a distance of 30 m rates about 50 dB at a distance of 600 m, the noise of a jet take off reaches about 110 dB, approximately the same as an automobile horn only 1m away. Subjected to 45 dB of noise, majority of people are unable to sleep. At 120 dB, the ear registers pain but hearing damage begins at a much lower level, about 85 dB [11].

The current study has measured the noise in 3 different locations, Piramerd, Mawlawi and Goran Street in the center of city in different days of June 2014 using a high quality Sound Level Meter (SLM) with a range of 43-130 dB.

### Study Area

Sulaimani is situated in North of Iraq and East of Kurdistan Region (35° 31' 26"-35° 35'37" North and 45° 2' 10"-45° 28' 48" East) at an altitude of 882 m above sea level [12]. It is surrounded by the mountains of Peramagron (west), Azmar (North) and Hazarmerd (South) of Zagros and the semi- hot plains of Sharazwr and Garmayan from east. The distance from the nearest sea exceeds one thousand kilometers from Persian gulf or Mediterranean sea. The climate of Sulaimani is semi-arid, and is mainly influenced by its inland position and prevalence of continental air during most of the years. All three locations (streets) in the center of the city are shown in Figure 1 which are the most crowded streets in the city.

### Results and Discussion

Figures 2-4 show variation of intensity of noise vs. time that occurred in June 2014 in the three streets, Goran, Peramerd and Mawlawi respectively from 9 am to 5 pm. These data are the average obtained after several observations for each day.

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Received December 02, 2014; Accepted December 16, 2014; Published December 26, 2014

Citation: Rauf KM, Hossieni H, Ahmad SS, Jamal S, Hussien A (2015) Comparison of the Noise Pollution in Sulaimani City between the Years 2009 and 2014. J Pollut Eff Cont 3: 133. doi:10.4172/2375-4397.1000133

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Figure 2 shows intensity of noise in Goran Street, this intensity varies between 55 to 65 dB while the data of noise for the same street in 2009 (Figure 5) showed that the intensity of noise was between 60-75 dB [8]. It can be noticed that the noise has a nearby 10 dB reduction.

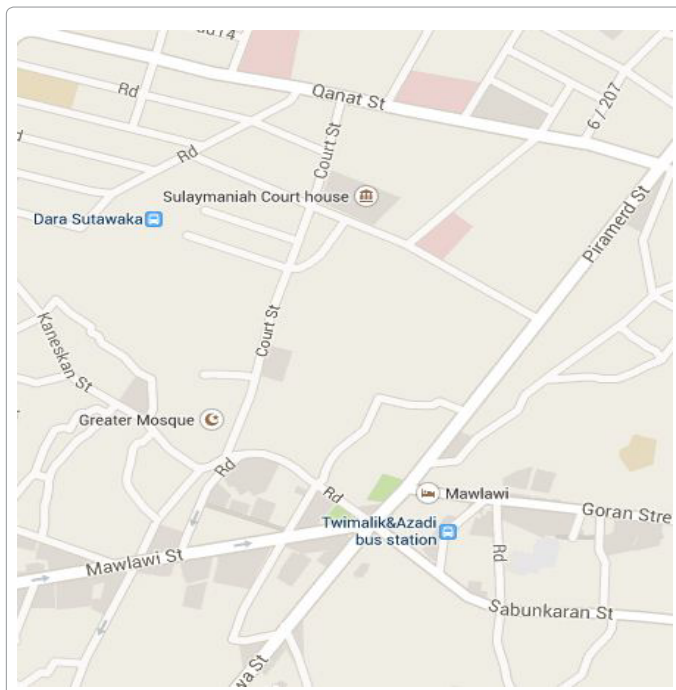


Figure 1: Map of the center of Sulaimani city by Google map.

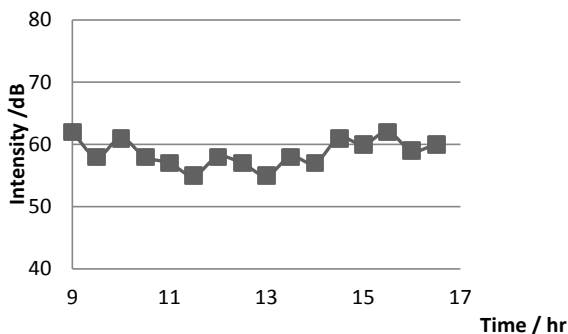


Figure 2: Intensity of Noise as a function of Time in Goran street.

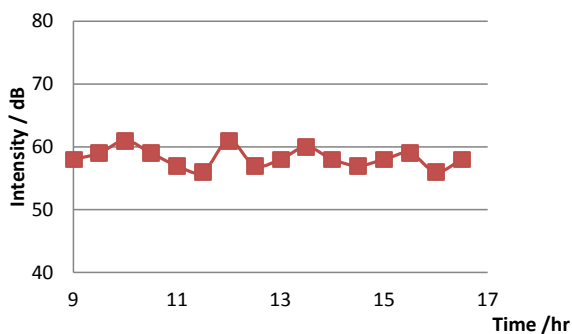


Figure 3: Intensity of Noise as a Function of Time in Piramerd Street.

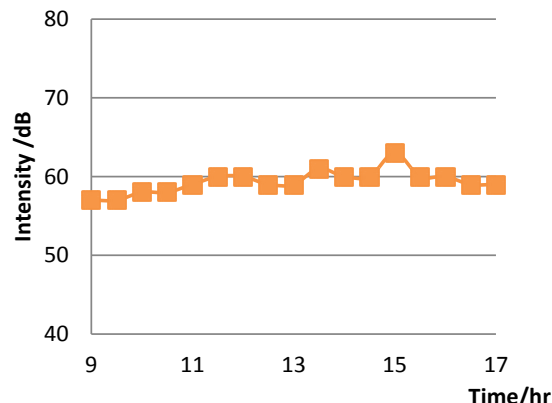


Figure 4: Intensity of Noise as a function of time in Mawlawi street.

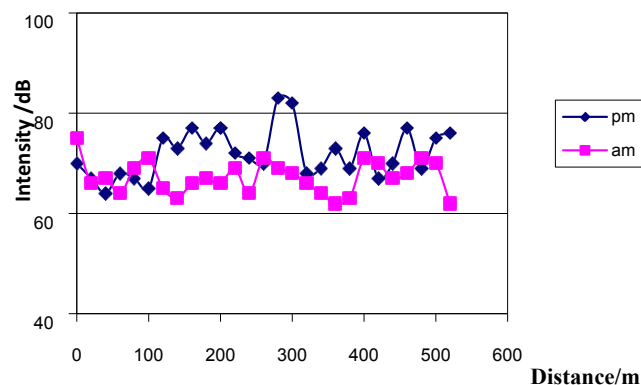


Figure 5: Intensity of noise as a function of distance in Goran street (2009).

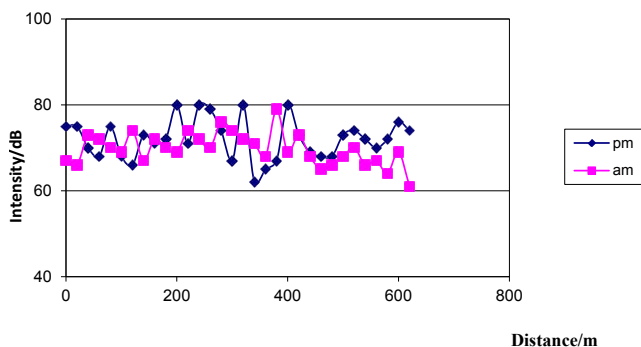


Figure 6: Intensity of noise as a function of distance in Peramerd street (2009).

Figure 3 shows that the intensity of noise in Peramerd Street varies between 55-60 dB in June of 2014 whereas in 2009 (Figure 6) the intensity was between 65-80 dB which shows a significant reduction in noise of about 15-20 dB in this street.

Figure 4 represents a fluctuation between 55-65 dB in noise intensity in Mawlawi Street. During the midday, this variation is smooth and high because of the busy markets in the street. However, the intensity of noise is also reduced by 15 dB comparing to the data of year 2009 (Figure 7).

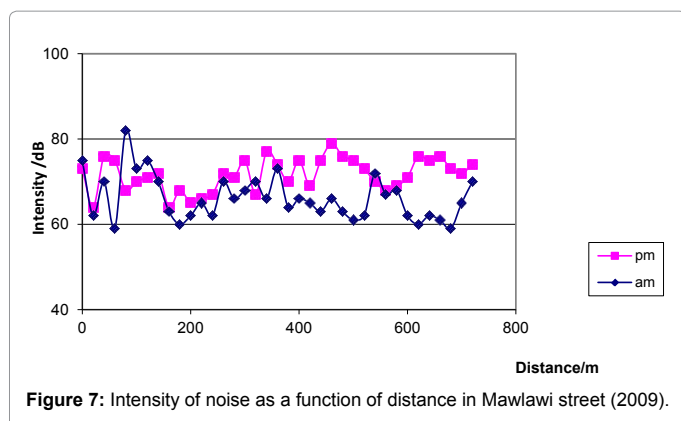


Figure 7: Intensity of noise as a function of distance in Mawlawi street (2009).

The current data show a remarkable reduction of the intensity of noise in all the streets in the center of Sulaimani city during the last 5 years of about 10-15 dB. This number is not negligible; many factors contribute in this lessening. For instance, the electricity system depended on the local generator in 2009 and they were producing a value of noise. On the other hand, traffic controls in the center of the city have been improved during these years and entering automobiles to this region is become limited. Moreover, there are many modern supermarkets in other locations around the city; therefore the markets in the center are less crowded than before. In addition to the above factors, another issue plays a big role in improving this reduction which is a public knowledge about noise and effect on their health.

## Conclusion

The study of noise pollution at three different locations in June 2014 in Sulaimani city of Kurdistan region was conducted. The study

revealed that day time noise level in all locations is still high compared to the standard noise level [1]. But at the same time, a remarkable diminishing can be seen compared to the data of year 2009. This significant reduction is a result of an organized city and increasing the public knowledge which can positively effect the health of the citizens.

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