



بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

***Lead (Pb) levels in Zarqa city and  
Al-Hashimyeh town of Hashemite  
Kingdom of Jordan***



***Eng. Faysal Anani ; Eng. Jehan Haddad***  
**Head of                      Researcher Assistant at**

***Air Quality Studies Division  
Environmental Research Center  
Royal Scientific Society***

# ABSTRACT



Lead (Pb) was one of the most significant air pollutants in Jordan mainly due to the emissions of leaded gasoline driven vehicles; therefore it was a major problem in traffic congested areas of Jordan until the use of unleaded gasoline in the beginning of 2008.

The results of one year monitoring program of lead daily concentrations at the ambient air of two sites in Zarqa governorate in 1998 are presented.

# ABSTRACT



Lead levels at the two monitoring sites were compared with the Jordanian ambient air quality standard limits (JS: 1140/ 1996). The results indicated that

only one seasonal average exceeded the Jordanian standard limit at the Zarqa city center

at which also the annual Jordanian standard limit was exceeded.

# ABSTRACT



The daily concentrations at this site (Zarqa City) were much higher than their equivalents in the second monitoring site (Municipal Building) in Al-Hashimyeh town and this could be due the higher traffic congestion at Zarqa city center in comparison with Al-Hashimyeh town.

# ABSTRACT



**The lead monitoring results show that the emissions of leaded gasoline driven vehicles could play major role in increasing the lead levels in the surrounding ambient air especially in the traffic congestion areas.**

# Introduction



Lead emitted from the combustion of leaded gasoline in the vehicles was one of the most significant air pollutants in Jordan ; therefore it was a major problem in traffic congested areas of Jordan until the use of unleaded gasoline in the first of 2008.

Lead does not exist naturally in gasoline; it is added to it in order to increase the gasoline Octane number and enhance its performance in inexpensive way.



# Introduction

**“The lead could adversely affect nervous system, kidney function, immune system, reproductive and developmental systems and the cardiovascular system, depending on the level of exposure, in addition it affects the oxygen carrying capacity of the blood, taking into consideration that infants and young children are especially sensitive to even low levels of lead.**

# Introduction



During the period (15/12/1997–30/12/1998), the daily concentrations of lead were monitored in two sites; one in Zarqa city (Police Station) and the other in Al-Hashimyeh town (Municipal Building) in Zarqa governorate that is considered as the second high populated area in Jordan (more than 1.5 million inhabitants) and it is located around 30 km to the east of Amman.

# Introduction



**This study shows and discusses the lead monitoring results at these sites that could be used as significant baseline data and compared with lead levels after stopping the use of leaded gasoline.**

# Introduction



It is worth to mention that this study is not the only one that concerns of lead exposure in Jordan, in 1998-2000, blood lead (PbB) levels in 382 children of 2-6 years of age, living in areas located less than 200 m from the main streets, were measured in nine governorates of Jordan (each with a population of  $> 100,000$  inhabitants) using a fingerstick method .

The findings showed that the risk for  $PbB > 10 \mu\text{g/dL}$  in children was less than 1%. The percentages of children with PbB levels between 5 and  $9.9 \mu\text{g/dL}$  was 12%, most (55%) of the children examined had  $PbB < 3 \mu\text{g/dL}$

# Description of the monitoring sites



***Municipal Building:*** it is located in Al-Hashimyeh town next to the main street (Irbid– Al-Hashimyeh – Zarqa).



# Description of the monitoring sites



***Police Station:*** it is located in Zarqa city next to the cross of Al-Jesh street (Irbid – Zarqa – Amman) and King Hussein street which passes through the center of Zarqa city.



# Monitoring methodology



Total suspended particulates (TSP) concentrations in the ambient air of the two monitoring sites were monitored by using high volume samplers by which the particles that have up to 100 microns were collected on special filters (fiber glass) during 24-hours a day.

Then these filters were digested and the resulted solutions were analyzed by atomic absorption device at RSS laboratories in order to determine the lead concentrations, and accordingly to calculate the lead concentrations in the ambient air.

All used monitoring and analysis equipments were regularly maintained and calibrated.

The daily monitoring of TSP and Pb was conducted two times a week at each monitoring site during the one year monitoring period.

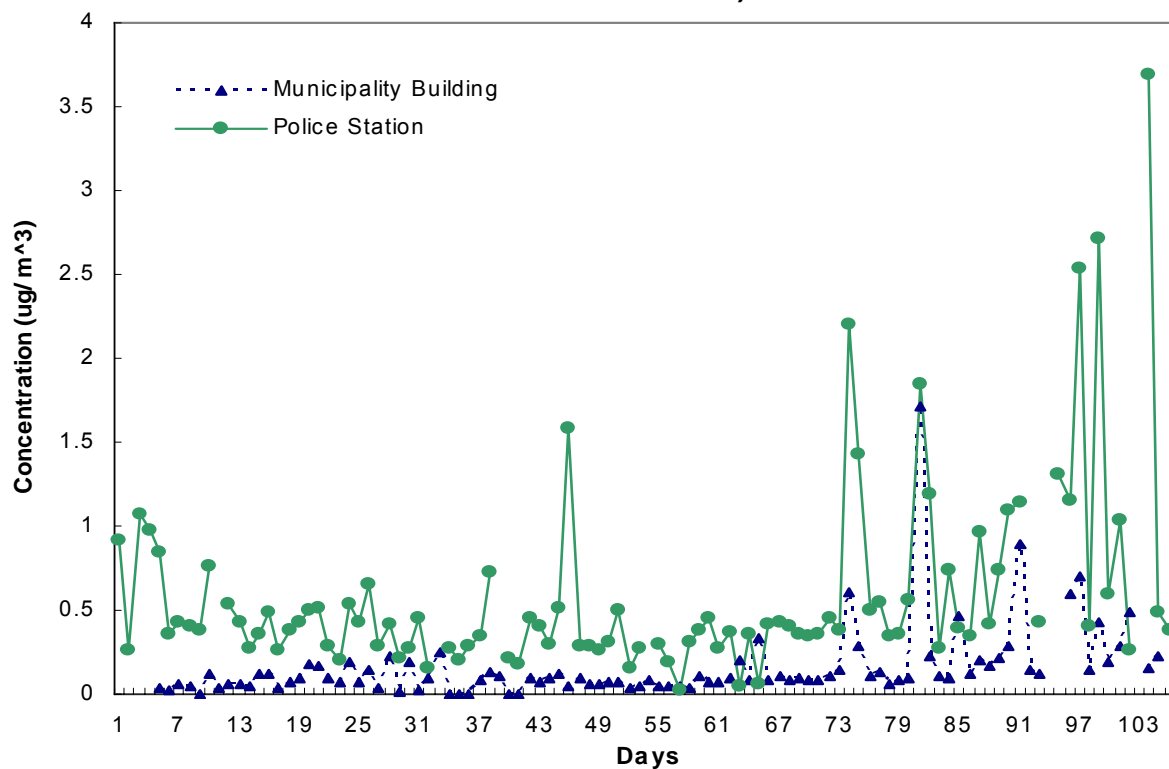
# Monitoring methodology



# Results and Discussion



**Fig. 1: Daily averages of Lead (Pb) concentrations at *Municipal Building/ Al-Hashimiyeh* and *Police Station/ Zarqa* (15/12/1997 - 30/12/1998)**



# Results and Discussion



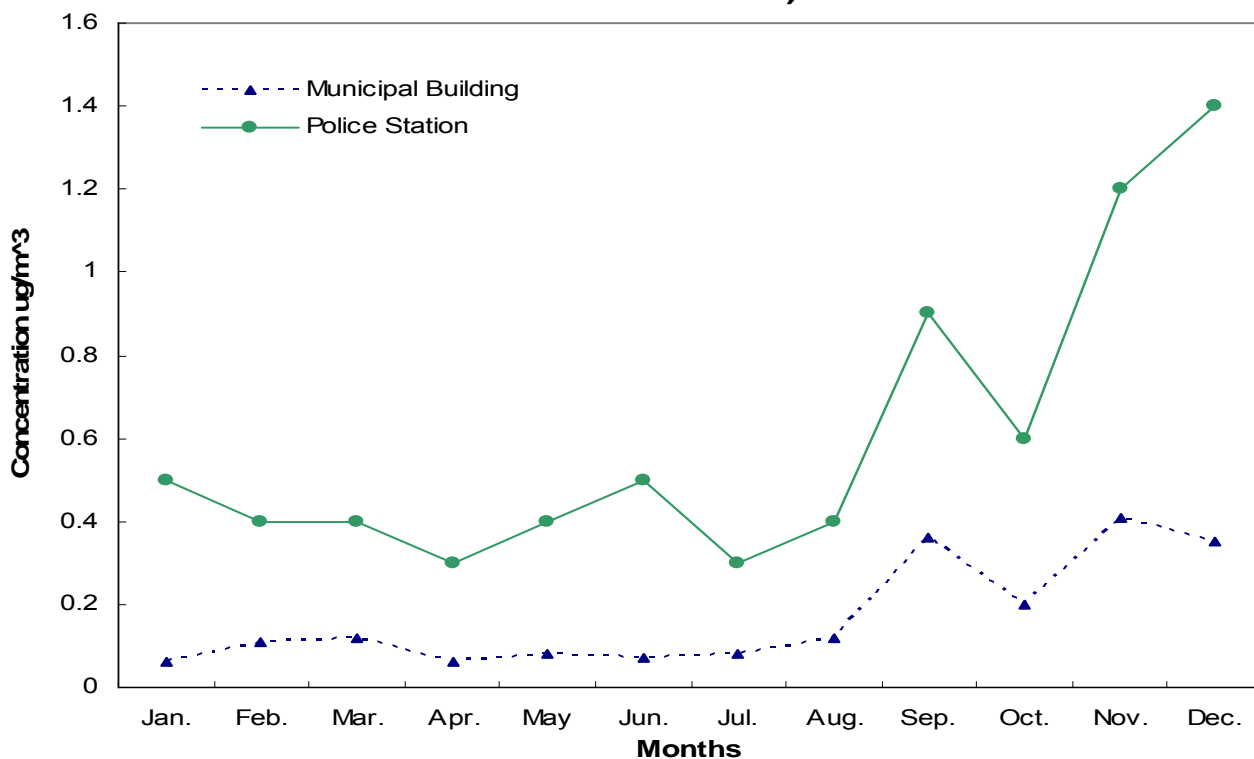
**Table (1): Annual arithmetic and geometric means, maximum and minimum daily averages of lead at the monitoring sites during the period (15/12/1997 - 15/12/1997)**

Site	No. of samples	Maximum daily average (ug/ m <sup>3</sup> )	Minimum daily average (ug/ m <sup>3</sup> )	Arithmetic mean (ug/ m <sup>3</sup> )	Geometric mean (ug/ m <sup>3</sup> )
Municipal Building	98	1.71	Less than detection limit of 0.003	0.16	0.09
Police Station	100	3.69	0.02	0.6	0.44

# Results and Discussion



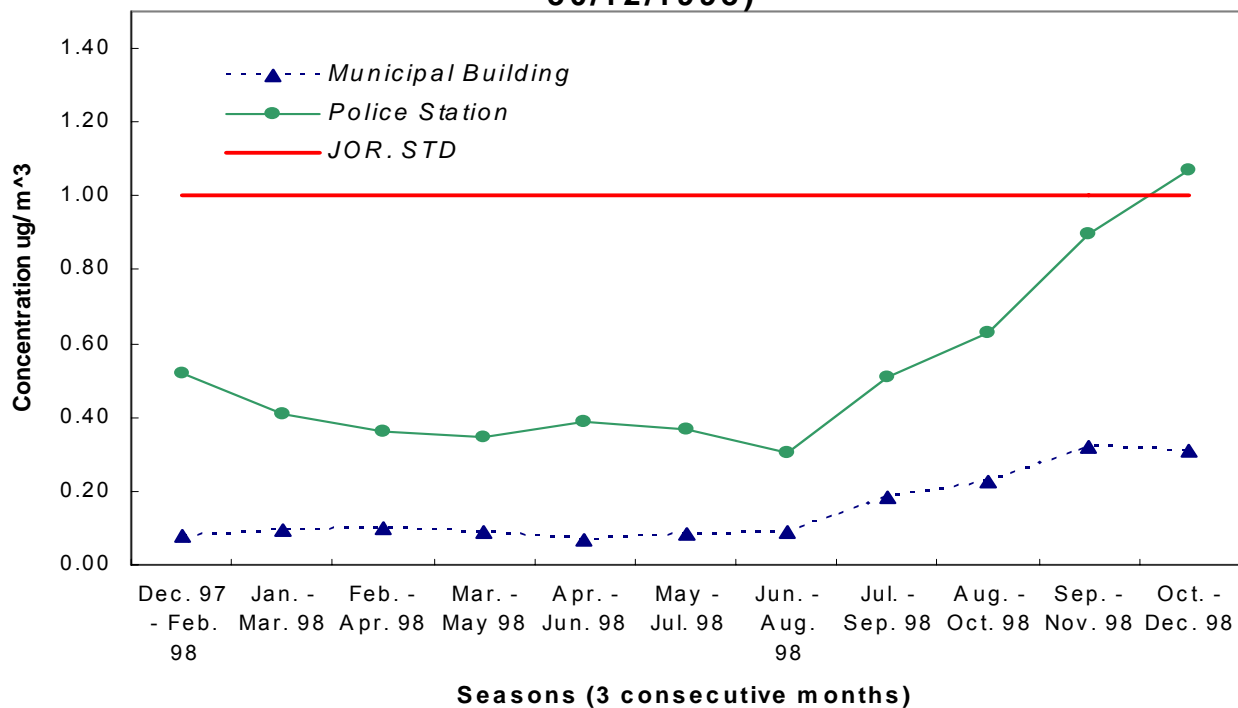
**Fig. 2: Monthly averages of Lead (Pb) concentrations at Municipal Building/ Al-Hashimyeh and Police Station/ Zarqa (Jan. - Dec. 1998)**



# Results and Discussion



**Fig. 3: Seasonal Pb levels at Municipal Building / Al Hashimyeh and Police Station / Zarqa (15/12/1997 - 30/12/1998)**



# Results and Discussion



In addition, the annual arithmetic average of lead concentrations at the ambient air of the Police Station site exceeded the allowable annual limit in the Jordanian standards of  $0.5 \mu\text{g}/\text{m}^3$  and reached a value of  **$0.6 \mu\text{g}/\text{m}^3$** , while the annual average in the Municipal Building was much less than the allowable limit and reached  $0.16 \mu\text{g}/\text{m}^3$ , see Table (1).

# Conclusions



The combustion of leaded gasoline in vehicles could increase the lead concentrations in the surrounding ambient air.

The study results show that the lead levels at the Police Station site in Zarqa city were higher than their equivalents at the Municipal Building site in Al-Hashimyeh town, and that these levels exceeded the seasonal allowable limit of the Jordanian standards of ambient air quality one time in the Police station site and no time in the Municipal Building site.

Additionally, the annual average of lead concentrations at the ambient air of the Police Station site exceeded the Jordanian standards limit.

# Conclusions



The lead levels were increased in the second half of 1998 (Aug. – Dec.) in both monitoring sites, the reasonable analysis of this trend is the increasing of vehicles number during Summer time mainly in August since the Jordanian workers come from abroad countries to be in Jordan during their vacation.

The cold weather without rain in Oct. – Dec. could increase the emissions from the vehicles since more consumption of gasoline is required at low temperatures.

# Conclusions



In addition, RSS was part in conducting one year monitoring of the lead concentrations in four Jordanian cities, one of them is the Zarqa city in which the highest levels of lead were recorded, and that emphasizes the importance of conducting one year monitoring of lead concentrations in Zarqa governorate after the application of using the unleaded gasoline and comparing the results with the baseline data.

# Conclusions



The higher traffic congestion at the Police Station site probably caused the higher levels of lead in comparison with the lead levels at the Municipal Building site, and this shows the importance of **finding an environmental friendly substitute for tetra ethyl lead** to improve the octane number of gasoline.

# Conclusions



**MTBE as *substitute* for tetra ethyl lead improves the air quality, but it can easily contaminate the ground water.**

**We have to think as soon as possible of a *substitute* for MTBE.**



*Thank you  
for your  
attention*

