

MEASUREMENT OF AMBIENT CARBON MONOXIDE AT THE ASUNCION CITY.

Acosta, N. C. R.; Martínez, C. G.
Univ. Nacional de Asunción - Facultad de Ciencias Exactas y Naturales
Laboratorio LIAPA, Campus de San Lorenzo

ABSTRACT

Paraguay is not outside of the problems related to the atmospheric contamination, in special to vehicular pollution that it is known well cause serious problems in the health of the man, the carbon monoxide (CO) is a toxic gas formed in all burning processes under insufficient oxygen conditions, his danger its increases especially due to his properties of being a colourless and odourless gas.

Accumulation of CO in the atmosphere is of concern to us, because its accumulation degrades the ambient air quality. Around the Metropolitan area of Asunción daily 2,500 vehicles are circulating emitting polluting to the atmosphere. Measurement of ambient CO was carried out using a Carbon Monoxide Meter CO10 of Extech Instruments, of 1 ppm of resolution and precision of $\pm 5\%$ in the micro centre zone of the Asunción city (25-16S, 57-38W), was measured only during the daytime. Preliminary results indicate that the CO ambient values are between 2.5 and 67.5 ppb, present diurnal variation and its response to land breeze is evident. The level of emission is intense in the rush hours of circulation and depends of the wheatear conditions.

INTRODUCTION

The polluting agents of the air can originate negative impacts on the health of the people when their air concentrations surpass significant levels. The contamination of the air is generated by a great amount of sources of emission one of them are the automotive vehicles. The automotive vehicles and specially those that consume gasoline (Mazzeo, 2003) are the most important and main emitting sources of polluting agents of the air in the urban centers.

Around Asunción and the Metropolitan area daily is circulating 2,500 vehicles (Ultima Hora, 2005), that are emitting polluting to the atmosphere mainly carbon monoxide (CO), that due to its colorless and odorless property of being is increased its danger.

Another source of CO, of comparable magnitudes is the combustion of fossil fuels, and the oxidation of the methane. At the moment also it must worry forest fires and you burn them of biomass, of agricultural remainders and vegetation that is being increased our country (Coronel et al, 2003), contributing to that great areas of the surface of the region (Fishman et al., 1991) are exposed to the increase of the CO concentration.

The carbon monoxide makes difficult to the normal transport of oxygen by the blood, reducing significant the amount of oxygen that goes to the heart, that can affect particularly the people who suffer mainly of disease cardiac and in the children (The UK National Air Quality).

The continuous exposition at high levels of CO in the air causes serious pathological effects, increasing the content of carboxihemoglobina in blood and causing adverse effects in the nervous and cardiovascular system (EPA, U.S). The problem with the contamination appears with certain gravity in those sites of the city with much automotive traffic, and great concentration of people of limited resources that are dedicated on sale informal in the streets. The damage that can not only cause a polluting agent depends on its concentration, but also on the time of exposition and the sensitivity of each person to the polluting agent at issue. The short average life of the carbon monoxide in the atmosphere (near a month) along with his varied sources implies that its concentration can vary regionally, the annual average of abundance in the North Hemisphere is around 100 - 125 ppb that it is approximately twice greater than the abundance average in the South Hemisphere of 50 - 65 (Novelli, et al., 1992). The process of dominant drain for the Carbon Monoxide is the reaction of CO with the radical hidroxilo (OH). The CO is a gas that is consumed by the hidroxilos radicals, that work like natural detergent that cleans the atmosphere of many poluentes. As the level of the CO is in increase, the abundance of the hidroxilos in the atmosphere is in diminution, and as a result of the same one the capacity decreases that has the atmosphere to clean

Corresponding author address. Reacalde, Carolina.
Fac.de Ciencias Exactas y Naturales.
LIAPA. Campus Univ. de San Lorenzo.
crecalde@liapa.facen.una.py

the pollution. This reaction also serves like a way of greater conversion of OH to H₂O. Of this east form process is important in the control of the OH and the CO in the tropósfera, the reduction of radical OH by the CO does that there is less OH available for the destruction of the methane, possibly leading to an increase of the heating by effect conservatory.

The measurements made in different critical important points from Microcentro of Asuncion indicate that the concentrations of the carbon monoxide are varying between 2,5 and 67,5 ppb, but the preoccupation comes from the consideration that the country does not count on national norms to take care of itself of the carbon monoxide.

This work presents/displays the space distributions of the emissions to the atmosphere of carbon monoxide in the Micro Center of Assumption, generated by the vehicles of automotive transport of passengers. The zones with greater relative emission are individualized and hour variations of the emissions appear.

It is important to know the horizontal distributions the emissions the atmosphere of the carbon monoxide in Microcentro of Asuncio'n, to individualize the zones with high levels of CO concentration, and its hour variations, this will allow to alert to the citizenship on the situated ones of potential risks for the human health.

METHOD OF MEASUREMENT.

The measurements of the carbon monoxide were made in the Micro Center of Asuncion (see Figure 1), in working days and during the diurnal hours, hours of greater automotive traffic. A "Extech Instruments, Model CO10", of a precision $\pm 5\%$ and calibration of factory, was used. The measurements in each site were made at intervals of 5 minutes, taking in consideration the answer from the ambient air to the change of the wind speed and its direction, and the site of measurement, at the same time to register the measurements estimativas information were written down on the temperature of the place (to see Table 1). Although the data are not of long data in the time, are of the most recent quantitative measurements made in the country.

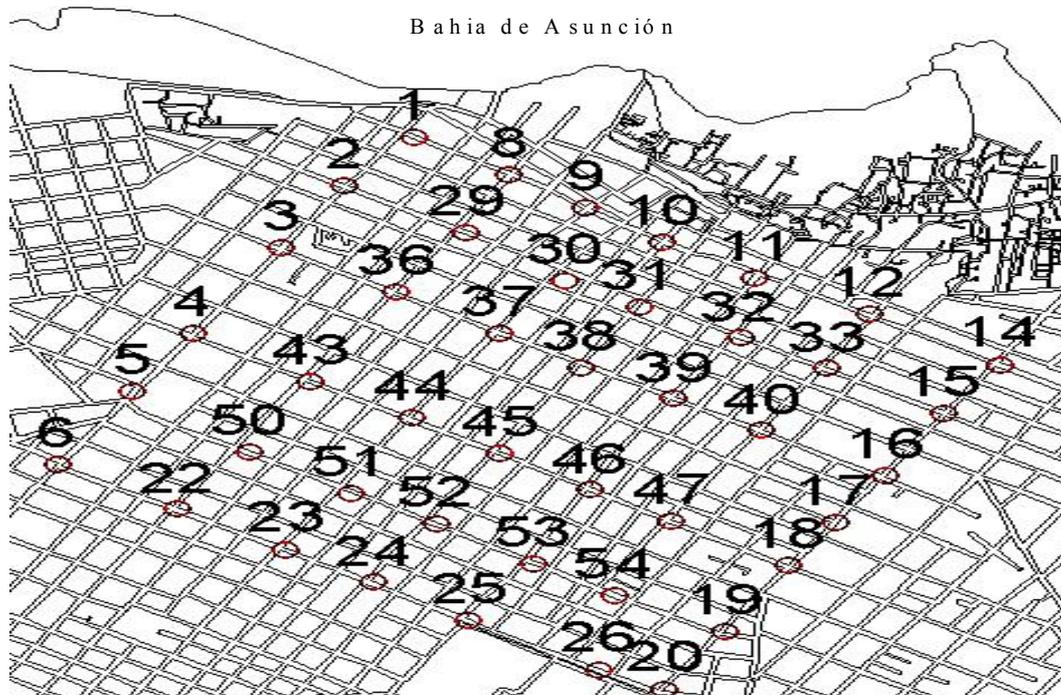


Figure 1: The site of measurements in the Micro Center of Asuncion

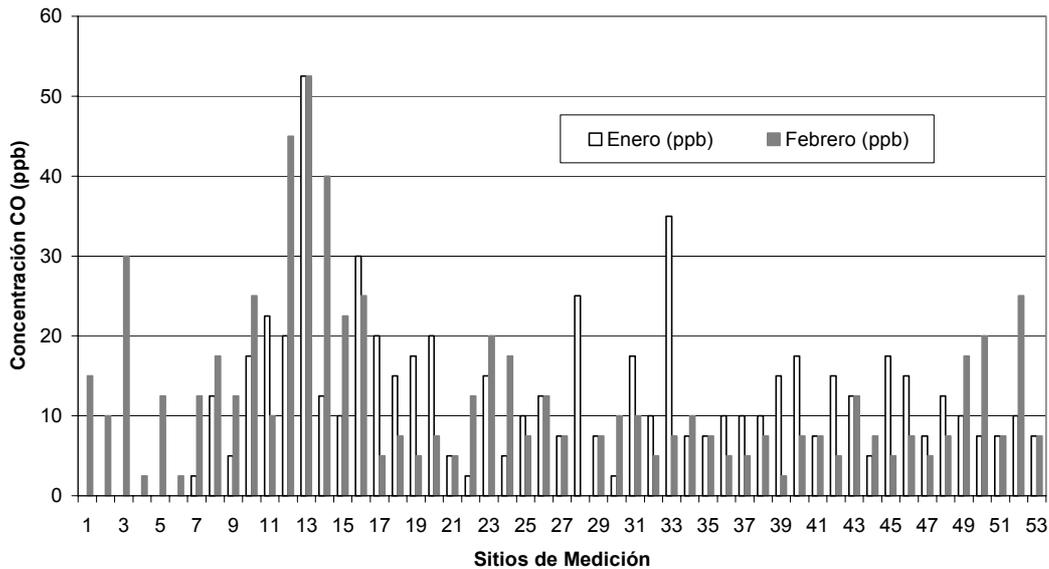
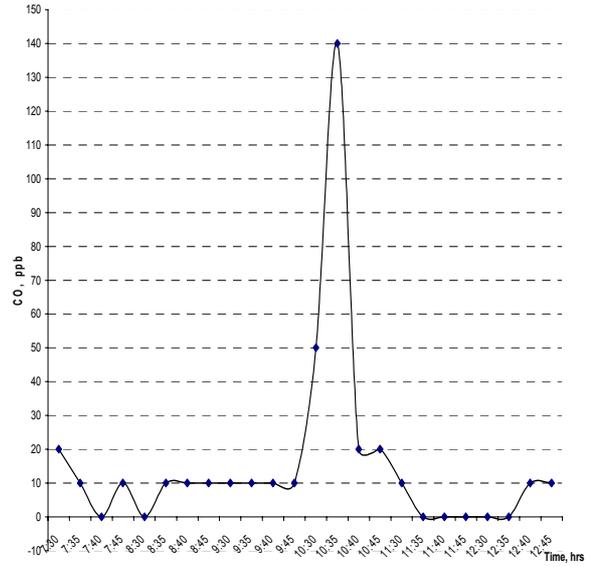
| Puntos | Latitud | Longitud | Altura (m) | Dirección | Puntos | Latitud | Longitud | Altura (m) | Dirección |
|--------|----------|----------|------------|---|--------|----------|----------|------------|---|
| 1 | 25,27778 | 57,64050 | 75 | Colón esq. Pte. Franco | 25 | 25,29613 | 57,63915 | 119 | Acuña de Figueroa esq. Caballero |
| 2 | 25,27960 | 57,64225 | 70 | Colón esq. Oliva | 26 | 25,29804 | 57,63586 | 137 | Acuña de Figueroa esq. Parapiti |
| 3 | 25,28197 | 57,64390 | 78 | Colón esq. Humaita | 29 | 25,28140 | 57,63914 | 112 | Oliva esq. O'Leary |
| 4 | 25,28521 | 57,64622 | 95 | Colón esq. Jejuí | 30 | 25,28324 | 57,63665 | 165 | Oliva esq. Alberdi |
| 5 | 25,28740 | 57,64775 | 108 | Colón esq. C. A. López | 31 | 25,28424 | 57,63476 | 157 | Cerro Corá esq. Ind. Nacional |
| 6 | 25,29017 | 57,64968 | 109 | Colón esq. Francisco Dupuis | 32 | 25,28545 | 57,63218 | 101 | Cerro Corá esq. Caballero |
| 8 | 25,27921 | 57,63807 | 90 | Pte Franco esq. Juan E. O'Leary | 33 | 25,28661 | 57,62995 | 98 | Cero Corá esq. Antequera |
| 9 | 27,28045 | 57,63610 | 77 | Pte. Franco esq. 14 de Mayo | 36 | 25,28366 | 57,64094 | 71 | Humaita esq. O'Leary |
| 10 | 25,28179 | 57,63416 | 85 | Pte. Franco esq. N. Sra. de la Asunción | 37 | 25,28524 | 57,63833 | 90 | Humaita esq. Alberdi |
| 11 | 25,28315 | 57,63176 | 85 | Dr. Eligio Ayala esq. Iturbe | 38 | 25,28656 | 57,63628 | 92 | Humaita esq. Ind. Nacional |
| 12 | 25,28455 | 57,62889 | 99 | Dr. Eligio Ayala esq. Antequera | 39 | 25,28775 | 57,63386 | 118 | F. R. Moreno esq. Caballero |
| 14 | 25,28646 | 57,62554 | 96 | E.E.U.U esq. Eligio Ayala | 40 | 25,28898 | 57,63163 | 107 | F. R. Moreno esq. Antequera |
| 15 | 25,28830 | 57,62698 | 109 | E.E.U.U esq. Cerro Corá | 43 | 25,28706 | 57,64319 | 96 | Jejuí esq. J. E. O'Leary |
| 16 | 25,29069 | 57,62847 | 98 | E.E.U.U esq. Fulgencio R. Moreno | 44 | 25,28844 | 57,64058 | 89 | Gral. Ibáñez del Campo esq. Alberdi |
| 17 | 25,29247 | 57,62978 | 110 | E.E.U.U esq. Sta María | 45 | 25,28980 | 57,63834 | 112 | Gral. Ibáñez del Campo esq. Ind. Nacional |
| 18 | 25,29408 | 57,63100 | 138 | E.E.U.U esq. Rep. de Colombia | 46 | 25,29120 | 57,63606 | 129 | Rpca. de Colombia esq. Caballero |
| 19 | 25,29660 | 57,63260 | 143 | E.E.U.U esq. Abay | 47 | 25,29241 | 57,63396 | 129 | Rpca. de Colombia esq. Antequera |
| 20 | 25,29877 | 57,63416 | 144 | E.E.U.U esq. Acuña de Figueroa | 50 | 25,28974 | 57,64476 | 110 | Milano esq. Juan E. O'Leary |
| 22 | 25,29189 | 57,64660 | 105 | Francisco Dupois esq. Juan E. O'Leary | 51 | 25,29129 | 57,64218 | 119 | Milano esq. Alberdi |
| 23 | 25,29343 | 57,64384 | 119 | Francisco Dupuis esq. Alberdi | 52 | 25,29244 | 57,63998 | 122 | Milano esq. Ind. Nacional |
| 24 | 25,29469 | 57,64161 | 115 | Francisco Dupuis esq. Ind. Nacional | 53 | 25,29401 | 57,63751 | 143 | Abay esq. Caballero |
| | | | | | 54 | 25,29520 | 57,63546 | 137 | Abay esq. Antequera |

Table 1. Reference of the sites of measurement.

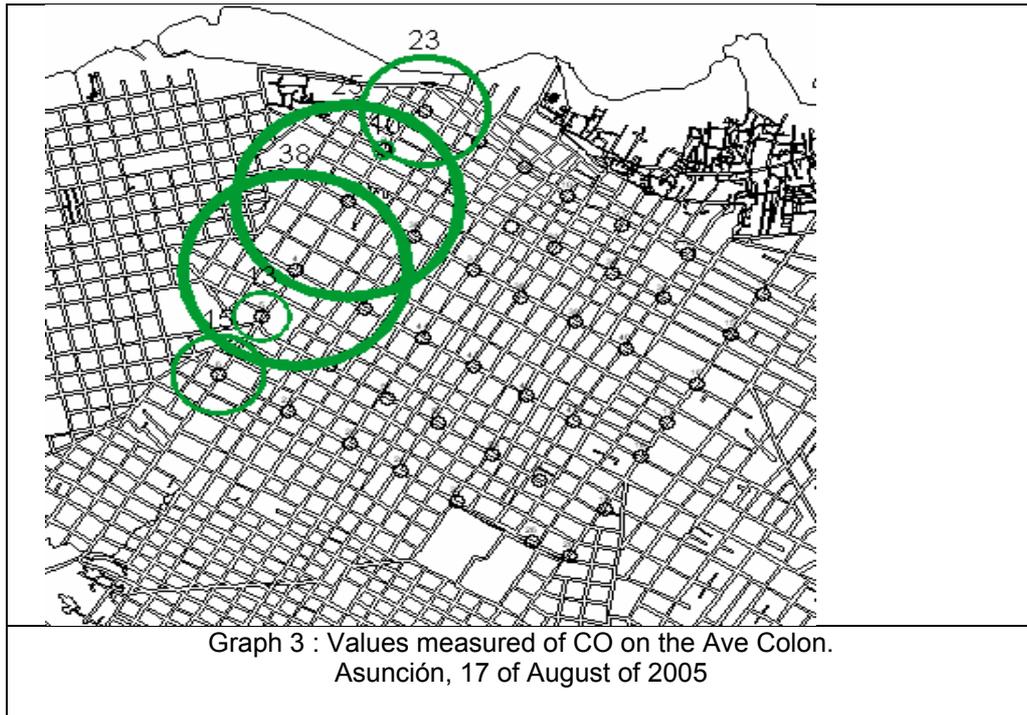
RESULTS AND DISCUSSION.

Although the data base made with the measured values of the carbon monoxide in the atmosphere is not of long data in the time, they are first and of recent measurements in the environs of the Micro Center of Asuncio'n, they can help to have an idea of the values and its behavior in a zone that this put under intense and constant I deal of automotive.

Graph 1: Variation of CO during the course of day, Mar 7, 2006, Ave. Olive with 14 of May, shown against Time.



Graph 2: Levels of Carbon Monoxide in the Center of Asunción; January and February of 2006.



Graph 1, shows the daily behavior of the levels of concentration of CO in function of horas. Mar 7, 2006, Av. Oliva with 14 of May, shown against time. The production of the CO is mainly of antropogénico origin, are produced by the emissions vehiculares. The atmospheric processes such as the movement of the air (wind) and the heat interchange (for example, the convection and the radiation) determine the destiny of the polluting agents as they happen through the stages of transport, dispersion, transformation and removal, showing greater levels in the mid-morning.

In Graph 2 are the values measured of the carbon monoxide levels in diferent site of Center of Asunción during January and February of 2006. during the month of February are the greater values of CO, the values is in the North zone of micro center, towards bahia of Asuncion.

The graph 3 show te values in the Colon Ave. of Asuncion, 17 of August of 2005.

CONCLUSIONS.

The emissions of polluting agents coming from the vehicles of automotive transport of passengers present/display hour variations that respond to the fluctuations of the frequency of circulation of the buses

* The levels of the carbon monoxide is very variable in micro center, can vary between 2.5 and 70 ppb, depending on the conditions of the time and the form of the automotive traffic by the zone. The level of emission is intense in the rush hours of circulation and depends of the wheatear conditions.

* Aunque the measured values are not worrisome for the health does not have to let alert themselves of their danger due to their physical characteristics of colorless and odorless.

* The wind direction has very significant effect in the accumulation and propagation of concentration.

ACKNOWLEDGEMENTS

The authors gratefully acknowledge the "Facultad de Ciencias Exactas y Naturales" of National University of Asuncion. The authors thank the IAI, for the support for the travel to 8th International Conference on Southern Hemisphere Meteorology and Oceanography.

REFERENCES.

Coronel G. et al, Incendios Forestales en Paraguay-Periodo febrero a junio 2003, <http://liapa.facen.una.py/>.

Diario Última Hora, viernes 2 de diciembre 2005.

U.S. Environmental Protection Agency
(EPA),
<http://www.epa.gov/iaq/pubs/coftspan.html>

Mazzeo N. ,Torres C. , EMISIONES
DE CO Y NOX EN LA CIUDAD DE BUENOS
AIRES. *Trabajo Presentado al 13° Congreso
Argentino de Saneamiento y Medio Ambiente.*

Novelli, P.C., L.P. Steele, and P.P.
Tans, Mixing ratios of carbon monoxide in the
troposphere, *J. Geophys. Res.* 97, 20731-
20750, 1992

Kumar.G. et al., Continuous
measurement of ambient carbon monoxide at
a tropical coastal station. *J. Ind. Geophys
Union.*, Vol. 8, No. 3, 205-210.

Recalde, C. Mediciones de monóxido
de carbono en el micro centro de Asunción,
Comunicación privada-LIAPA 2005.

The UK National Air Quality,
<http://www.airquality.co.uk/>