LIGHT DUTY VEHICLES EXHAUST EMISSION EVALUATION FOLLOWING BRAZILIAN AND ARGENTINEAN LEGISLATIONS

Antonio Carlos Scardini Villela
PETROBRAS Research Center (CENPES) – Cidade Universitária, Quadra 7 – 21949-900 – Rio de Janeiro – RJ – Brazil
antonio.villela@petrobras.com.br

Tadeu Cavalcante Cordeiro de Melo
PETROBRAS Research Center (CENPES) – Cidade Universitária, Quadra 7 – 21949-900 – Rio de Janeiro – RJ – Brazil
tcm@petrobras.com.br

Abstract. *According to its strategy to grow as an international company, PETROBRAS (Brazilian Oil Company) is increasing investments in Argentina's fuel market. Due to that, the company developed in its Research Center (CENPES), located in Rio de Janeiro, Brazil, and launched in Argentina, a new premium gasoline. The evaluation of this new fuel included vehicle exhaust emission tests.*

CENPES is strongly experienced in vehicle emission evaluation based on the Brazilian legislation (FTP-75 driving cycle). However, for the Argentina's market, it was necessary to adapt its Vehicle Test Laboratory to the Argentinean legislation requirements, which follows the European driving cycle (MVEG).

This paper reports the PETROBRAS accumulated knowledge while studying the Argentinean gasoline light duty vehicle emission legislation historic, current situation, and future trends, as well as a comparison of the main aspects to the Brazilian legislation.

It is also reported in this paper the company experience during the Argentinean emission cycle implementation in its emission laboratory, comparing its main characteristics to the Brazilian emission cycle.

Keywords*: emission, driving cycle, light duty vehicles, gasoline*

1. Introduction

Following its strategy as an international company, PETROBRAS acquired refineries and gas stations in Argentina. To improve its fuel market share in that country, the company worked on a new premium gasoline development that was launched in June 2004.

During this project, at PETROBRAS Research Center (CENPES), located in Rio de Janeiro, Brazil, it was performed vehicle tests to ensure the product quality, including its exhaust emission evaluation. However, before starting emission tests, the Argentinean gasoline light duty vehicle emission legislation was studied, regarding its historic, current situation and next steps. Also, CENPES Vehicle Test Laboratory equipments were adapted to attend such demand.

The accumulated knowledge during the Argentinean vehicle emission legislation studies allowed comparisons between adopted legislations in Brazil and Argentina, regarding the main aspects of each one, such as emission limits, driving cycles and reference fuels.

To get the laboratory equipments properly adjusted, some contacts were necessary, mostly with vehicle manufacturers in Brazil and Argentina, already experienced in this implementation, as well as with the laboratory emission measurement equipment supplier, to ensure the correct cycle profile, sampling and calculations procedures. After some adjustments in the software and preliminary tests, the Argentinean emission cycle was successfully implemented.

Most of the vehicles selected to run emission tests with the new premium gasoline were available in Brazil. According to the manufacturers, they had the same configuration, as used in Argentina, despites the different percentages of oxygenates blended on the gasoline for each country.

2. Emission Legislation

2.1. Emission Limits

Emission limits are the maximum pollutant gases quantity, in mass/distance, that vehicles should emit, running a standard cycle on a chassis dynamometer. These limits depend on the legislation adopted in each country or state and the main controlled gases are, in general, total hydrocarbons (THC) or non-methane hydrocarbons (NMHC), carbon monoxide (CO) and nitrogen oxides (NOx).

2.1.1. Brazil

In Brazil, CONAMA (National Environmental Council) created, in 1986, a program to control the vehicle emission, called PROCONVE (Motor Vehicle Air Pollution Control Program), which establishes the vehicle exhaust emission limits. It has been implemented in phases: the first one started in 1989 and the last foreseen phase will begin in 2009. Table 1 shows the PROCONVE phases for gasoline light duty vehicles.

Table 1. Brazilian Emission Limits for gasoline Light Duty Vehicles

<table>
<tr><th>Year</th><th>PROCONVE Phase</th><th>Application</th><th>CO (g/km)</th><th>THC (g/km)</th><th>NMHC[1] (g/km)</th><th>NOx (g/km)</th></tr>
<tr><td>1989</td><td>I</td><td>All</td><td>24,0</td><td>2,1</td><td rowspan="3">---</td><td>2,0</td></tr>
<tr><td>1992</td><td>II</td><td>All</td><td>12,0</td><td>1,2</td><td>1,4</td></tr>
<tr><td>1997</td><td>III</td><td>All</td><td rowspan="5">2,0</td><td>0,3</td><td>0,6</td></tr>
<tr><td>2005</td><td rowspan="3">IV</td><td>40% sales</td><td rowspan="4">0,3[2]</td><td rowspan="3">0,16</td><td rowspan="3">0,25</td></tr>
<tr><td>2006</td><td>70% sales</td></tr>
<tr><td>2007</td><td>All</td></tr>
<tr><td>2009</td><td>V</td><td>All</td><td>0,05</td><td>0,12</td></tr>
</table>

[1] Non methane hydrocarbons; [2] Natural gas vehicles only

Vehicle exhaust emission limits reduction has demanded new technologies implementation by vehicle manufacturers, such as electronic fuel injection systems and catalysts, in order to attend the proposed targets. Refiners also have been worked on the development of cleaner and higher quality gasoline, in order to contribute to the vehicle pollution control.

A Comparison between phase I (1989) and phase V (2009) emission limits, shows reductions of 91,7% for CO and 94% for NOx. THC limits decreased 85,7% between 1989 and 1997 and NMHC will be decreased 68,7% in 2009.

To reach the PROCONVE phase II (1992) emission limits, manufacturers used singlepoint electronic fuel injection or assisted electronic carburetor and catalysts. However, to attend PROCONVE phase III (1997) limits, all vehicle manufacturers had to introduce more advanced technologies, such as multipoint electronic fuel injection combined with the catalysts.

As shown in Tab. 1, PROCONVE phase IV, started in January 2005, requiring the measurement of NMHC, instead of THC for gasoline vehicles. This is because methane is a non reactive gas, with low influence in the cities pollution, despite its importance to the global warming, such as carbon dioxide (CO_2), which is also not legislated.

The NMHC requirement and also the NOx new limit value will be introduced in steps, until 2007, when all sold fleet will have to match 0,16 g/km to NMHC and 0,25 g/km to NOx exhaust emissions. This significant reduction can be explained by the great effects of these gases in the cities pollution. They make part of photochemical reactions, which form tropospheric ozone, a harmful health gas. There will be a challenge for the natural gas vehicles to match the NOx limits, due to the characteristics of this fuel combustion. Phase V establishes lower emission limits for these pollutant gases to be attended in 2009.

Since CO levels in the cities are not critical and the adopted limit of 2,0 g/km is already very restricted, it will remain the same from phase III up to phase V.

PROCONVE also establishes emission limits for aldehydes, but this pollutant was not evaluated in this paper because it is critical only for ethanol vehicles. Concerning the flex fuel vehicles fleet growth in Brazil, it should occur an increasing of this pollutant gas emission in the next years, but is not the focus of this paper to discuss this matter.

2.1.2. Argentina

In Argentina, since January 2004, SAyDS (Environmental and Sustainable Development National Department) established that the emission limits for new light duty vehicles models, must be those adopted in European Directives 94/12/CE and 96/69/CE (EURO II).

Along 2004 and 2005, existing vehicle models manufactured before 2004, may still meet the emission limits established since 1998 (equal to PROCONVE phase III limits) or, alternatively, those prescribed in European Directives above mentioned.

In 2006, Argentinean emission limits will be those prescribed in the legislation adopted in Europe until 2004 (EURO III). All these limits are shown in Tab. 2.

Table 2. Argentinean Emission Limits

Year	Application	Cycle	CO (g/km)	HC+NOx (g/km)	HC (g/km)	NOx (g/km)
1998	Existing Models Before 2004	FTP-75	2,0	---	0,3	0,6
2004	New Models (All) and Existing Models Before 2004 (Alternative)	MVEG (All) FTP-75 (Alternative)	2,2	0,5	---	---
2006	All	NMVEG	2,3	---	0,2	0,15

Argentinean government did not decide yet the next phases for vehicle emission control. In Europe, where Argentina based its emission legislation, it was started, in January 2005, a new phase (EURO IV), establishing emission limits, according to Tab. 3.

Table 3. Current European Emission Limits

Year	Application	Cycle	CO (g/km)	THC (g/km)	NOx (g/km)
2005	All	NMVEG	1,0	0,1	0,08

It can be noticed that Argentinean gasoline light duty vehicles emission legislation follows the same trends of the Brazilian legislation with reduction along the years, mainly, to the hydrocarbons and nitrogen oxides.

During 2004 and 2005 in Argentina, if the European Directives limits are adopted, there are no separated limits to THC and NOx. They are accounted together and its sum must attend the legislated limit (0,5 g/km).

Other common characteristic between both countries emission legislation is the CO emission limit maintenance (in Argentina it is observed a small increase). However, if Argentina continues to follow the European emission legislation, besides the THC and NOx reductions, it is possible that the CO emission limit also decreases, regarding that the current European limits (EURO IV) are 50% lower than those prescribed in the last Argentinean legislation phase.

2.2. Emission Cycles

Emission cycles concern the adopted driving conditions to determine the pollutant gas mass per distance emitted by a vehicle in a laboratory. These cycles are prescribed by standards and are performed in a chassis dynamometer to simulate urban, road or both driving conditions.

2.2.1. Brazil

In Brazil, for vehicle emission tests, it is used the Norm ABNT NBR 6601, which prescribes the FTP-75 driving cycle, followed in the U.S.A., in kilometers instead of miles. Table 4 and Fig. 1 show the main characteristics of FTP-75.

Table 4. FTP-75 Driving Cycle adopted in Brazil Main Characteristics

	Time (s)	Distance (km)	Average Speed (km/h)	Maximum Speed (km/h)
Phase 1	505	5,8	41,12	91,25
Phase 2	864	6,2	25,88	55,20
Phase 3	505	5,8	41,12	91,25
Total	1874	17,8	34,12	91,25

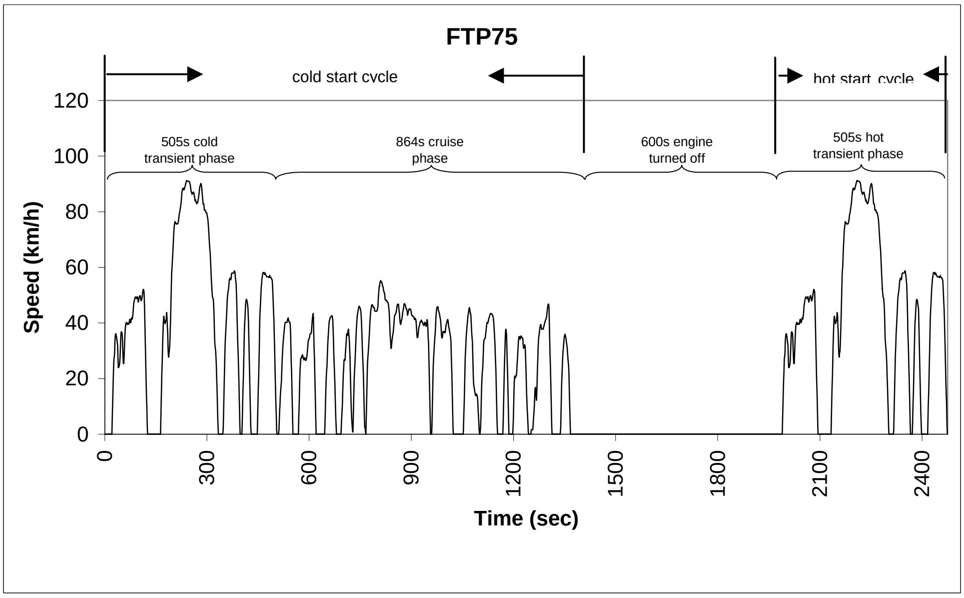

Figure 1. FTP-75 Driving Cycle

The complete test consists of two parts: the first one contains the phase 1 (505s cold transient phase) and phase 2 (864s cruise phase) and is considered as the "cold start cycle"; the second one is performed after 600 seconds with the engine turned off, contains the phase 3 (505s hot transient phase) and is considered as the "hot start cycle".

The exhaust gases are diluted with controlled ambient air and sampled in bags along the cycle, according to constant volume sampling technique (CVS). The equipment contains one pair of bags for each phase. Each pair is filled with diluted exhaust gas in one bag and ambient air in the other bag.

The final calculations for each pollutant emission (HC, CO, NOx and CO_2) is in g/km, and is a weighted sum of the "cold start cycle" (43%) and "hot start cycle" (57%) results. The "cold start cycle" portion is obtained considering the "505s cold transient phase" and "864s cruise phase" values. The "hot start cycle" portion is calculated with the "505s hot transient phase" value and the same "864s cruise phase" value obtained during the "cold start cycle" performing.

Between 12 and 36 hours before the first test, the vehicle must be pre-conditioned running phase 1 and phase 2, and remain in a soak area with ambient temperature between 20°C and 30°C. In a test sequence, the previous test works like a pre-conditioning to the following test.

2.2.2. Argentina

The Argentinean legislation prescribes the European driving cycle version, used in that continent until 2000, to determine the emission results. This European emission cycle is also called MVEG (Motor Vehicle Emission Group) and its profile and main characteristics are presented in Tab.5 and Fig. 2.

Table 5. MVEG Driving Cycle Main Characteristics

	Unit	Part 1	Part 2
Distance	km	4 x 1,013 = 4,052	6,955
Time	s	40 (idling) + 4 x 195 = 820	400
Average Speed	km/h	18,7 (including idling)	62,6
Maximum Speed	km/h	50	120

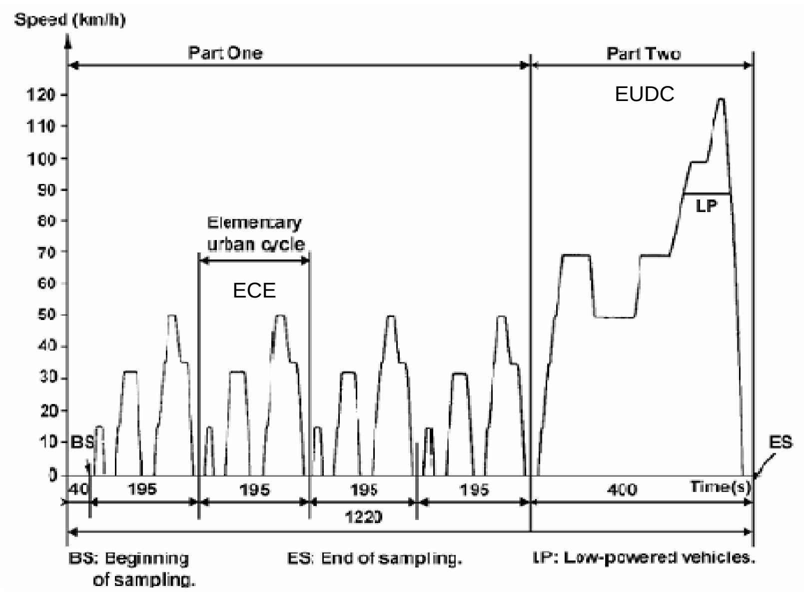

Figure 2. MVEG Driving Cycle

The complete European emission cycle used in Argentina contains two parts. "Part one" includes a 40 seconds idling period and four segments ECE (Elementary Urban Cycle). It simulates typical European urban driving conditions. "Part two" is performed immediately after "part one", consisting of one segment EUDC – Extra Urban Driving Cycle and representing a European road driving condition.

Exhaust gases are sampled continuously, starting immediately after the 40 seconds idling period (BS) until the end of the entire cycle (ES), and not by phases like in FTP-75. The final value for each pollutant, in g/km, is the total mass emitted divided by the total distance performed.

The ECE segment is characterized by low speeds and low engine loads, meaning lower temperatures in the catalyst, while EUDC part develops high speeds, meaning higher temperatures in the catalyst. The LP constant speed 90km/h segment is applied for low powered vehicles (< 30kW).

Since 2000, in Europe, the idling period was eliminated. It modified the cold start procedure, but the sampling times remained the same. This new cycle is called NMVEG (New MVEG). Argentina will start to adopt it in 2006.

Before the first test, the vehicle must be pre-conditioned, running a complete cycle with an option to repeat "part two". The first test should start after the vehicle soaks for at least 6 hours in an area with ambient temperature between 20°C and 30°C and it should remain until the engine oil and coolant fluid reach ± 2°C from the ambient temperature. The shorter interval between tests in this emission cycle allows running more tests in the same period of time (if respected the conditions above), when compared to the emission cycle adopted in Brazil. In a test sequence, the previous test works like a pre-conditioning to the following test.

Such as FTP-75 driving cycle, the exhaust gases are diluted with ambient air and sampled in bags along the cycle, according to CVS technique. The result of each pollutant (HC, CO, NOx and CO_2) is calculated in g/km.

2.3. Reference Fuels

Concerning the gasoline light duty vehicles emission results standardization, tests to evaluate emission limits accomplishment are performed using a standard gasoline, which has different specifications, according to the emission legislation adopted.

2.3.1. Brazil

In Brazil, the CNP (Petroleum National Council) Resolution n.01/1989 specified the standard gasoline used in emission and fuel economy tests until February 2005. Since then, the ANP (National Petroleum, Natural Gas and Biofuels Agency) technical regulation n. 02/2005 establishes the current specification to the standard gasoline. Both main specifications are presented in the Tab. 6.

Table 6. Former and Current Brazilian Standard Gasoline Specification

Characteristic	Unit	CNP 01/89		ANP 02/2005			
		Gasoline A[1]	Method	Gasoline A[1]	Gasoline C[2]	ABNT	ASTM
Anhydrous Ethanol[3]	%vol	0	CNP209/81	0	22±1	NBR 13992	-
Specific Gravity	Kg/m³	730,0 to 760,0	NBR 7148	719,5 to 757,9	735,0 to 765,0	NBR 7148 NBR 14065	D 1298 D 4052
Initial Boiling Point	°C	30 to 40	NBR 9619	30 to 40	-	NBR 9619	D 86
Final Boiling Point	°C	190 to 215		195 to 215	-		
MON	-	80, min	MB-457	-	82 to 85	MB-457	D 2700
RON	-	93, min	D 2699	-	93 to 98	-	D 2699
Reid Vapor Pressure, RVP	kPa	55,0 to 65,0	MB-162	-	54,0 to 64,0	NBR 14149	D 4953
Existent Gum, max	mg/mL	0,05	MB-289	0,05	-	NBR14525	D 381
Induction Period	min	480	MB-288	-	1000	NBR 14478	D 525
Copper Corrosion	-	-	-	1	1	NBR 14359	D 130
Sulfur, max	%m	0,12	NBR 6563	0,05	0,04	NBR 6563	D 1266
Lead, max [4]	g/L	0,013	D 3237	0,005	0,005	-	D 3237
Aromatics, max	%vol	35	MB-424	51,3	40,0	NBR 14932	D 1319
Olefins, max	%vol	45	MB-424	25,7	20,0		

[1] Gasoline with 0%vol ethanol blending; [2] Gasoline with 20%vol to 25%vol ethanol blending; [3] According to the standard ethanol specifications; [4] Addition prohibited. Should be measured when suspected contamination.

Brazilian government requires an addition between 20%vol and 25%vol of Anhydrous Ethanol in commercial gasoline. Nowadays, the gasoline has 25%vol ethanol blending, but the ANP regulation determines that standard gasoline must match 22 ±1%vol. ANP also provides the 0%vol ethanol standard gasoline specification to ensure properties such as distillation and specific gravity meet the requirements. CNP resolution n.01/1989 specified only the 0%vol ethanol standard gasoline.

Comparing the CNP Resolution n.01/1989 to ANP Technical Regulation n.02/2005, it is observed that:

- The olefins content requirements decreased to meet a better stability and smaller gum formation. It is also verified by the increasing of the induction period minimum time required;
- Lead was blended in Brazilian gasoline in the past to obtain a better octane requirement, but its addition was prohibited in the beginning of the 90's;
- Sulfur content has been restricted in the new gasoline specifications and it is observed in the ANP 02/2005, adjusting it to the levels that are being produced by PETROBRAS. It is important to observe that olefins and sulfur contents are dependent, when reducing the first one, the second one follows the same trend. So, this is another reason to promote olefins reduction;
- MON minimum requirement increased and it was also established maximum values for the octane numbers. It should be mentioned that ANP new regulation requires the octane measurement in the gasoline C, instead of A;

- The environmental impact of vehicle emission has also encouraged reductions in the gasoline specific gravity and RVP values. ANP 02/2005 also concerns the gasoline corrosion characteristics, which was not covered by CNP 01/1989, demanding the copper corrosion test.

2.3.2 Argentina

Table 7 shows Argentinean current and future main specifications and the current main specifications in Europe for standard gasoline.

Table 7. Current and Future Argentinean Specifications and Current European Specification for Standard Gasoline

Characteristics	Unit	Current Argentinean – 2004 – 2005 (EURO II)			Future Argentinean – 2006 (EURO III)			Current European – 2005 (EURO IV)		
		Min	Max	Method	Min	Max	Method	Min	Max	Method
RON		95,0	-	D 2699	95,0	-	EN 25164	95,0	-	EN 25164
MON		85,0	-	D 2700	85,0	-	EN 25163	85,0	-	EN 25163
Specific Gravity	kg/m³	748	762	D 1298	748	762	ISO 3675	740	754	ISO 3675
RVP	kPa	56,0	64,0	D 323	56,0	60,0	EN 12	56,0	60,0	PR.EN-ISO13016 -1(DVPE)
Initial Boiling Point	°C	24,0	40,0	D 86	24,0 %vol	40,0 %vol	EN-ISO 3405	-	-	-
90% evap.		155,0	180,0		-	-	-	-	-	-
Evap. 150°C		-	-	-	81,0 %vol	87,0 %vol	EN-ISO 3405	83,0	89,0	EN-ISO 3405
Final Boiling Point	°C	190,0	215,0	D 86	190,0	215,0		190,0	210,0	
Olefins	%vol	-	20,0	D 1319	-	10,0	D 1319	-	10,0	D 1319
Aromatics		-	45,0[1]	D 3606 D 2267	28,0	40,0	D 1319	29,0	35,0	D 1319
Benzene	%vol	-	-	-	-	1,0	Pr. EN 12177	-	1,0	Pr. EN 12177
Induction Period	min	480	-	D 525	480	-	EN-ISO 7536	480	-	EN-ISO 7536
Oxygen	%m	-	-	-	-	2,3	EN 1601	-	1,0	EN 1601
Existent Gum	mg/mL	-	0,04	D 381	-	0,04	EN-ISO 6246	-	0,04	EN-ISO 6246
Sulfur	mg/kg	-	400	D 1266 D 2622 D 2785	-	100	Pr. EN-ISO / DIS 14596	-	10	D 5453
Copper Corrosion	-	-	1	D 130	-	1	EN-ISO 2160	-	Class 1	EN-ISO 2160
Lead[2]	mg/L	-	5	D 3237	-	5	EN 237	-	5	EN 237

[1] Including 5%vol maximum of benzene; [2] Addition prohibited

Comparing current (EURO II) to next (EURO III) Argentinean standard gasoline specification it is observed that:

- The maximum RVP will be restricted, which concerns the emission reduction. Distillation curve results will be reported in percentage evaporated volume, unless the final boiling point, which will remain in °C;
- There will be a decrease in the maximum aromatics and benzene contents, because the first one is, generally, related to the gasoline heavy fractions and the second one is harmful to people's health;
- It will be allowed a 2,3%mass maximum of oxygen. Current specification does not require this measurement;
- The most important change will be the sulfur content restriction, falling from 400ppm to 100ppm. Lower sulfur contents improve the vehicle catalysts efficiency, reducing the exhaust emission. Besides that, it is related to olefins decrease, which contributes to the gasoline oxidation stability.

Considering the Argentinean trend to follow the European emission legislation, a comparison between the next Argentinean standard gasoline (EURO III) and the current European standard gasoline (EURO IV) specifications was made and it could be noticed that:

- Specific gravity has a lower maximum value, evaporated volumes in the intermediate temperatures are higher and final boiling point is 5°C lower. These changes are specified in order to turn the gasoline lighter;
- Sulfur, aromatics and benzene contents are more restrictive, keeping the objective of vehicle emission reduction and people health preservation in the big cities.

In general, when comparing the standard gasoline specification evolution, it is observed that Brazil and Argentina are following the same trends, despite they are using different specifications. Sulfur and olefins contents reduction, restrictions in the specific gravity and RVP are the main concerning points, looking for better oxidation stability and lower exhaust emission.

4. Argentinean Cycle Implementation in CENPES Vehicle Test Laboratory

The European emission cycle adopted in Argentina was available in the software that controls the Vehicle Test Laboratory chassis dynamometer and the pollutant analyzers, however it had never been used before. After some contacts with Brazilian and Argentinean vehicle manufacturers, already experienced in that emission cycle, as well as after technical visits to the two existents emission laboratories in Argentina, it was possible to run preliminary tests and to execute team training.

During these tests, it was adjusted some points that were not correct in the software and are listed bellow:

- The required gear shifts points and the 40 seconds idling period did not exist in the software. To solve these problem it was necessary to introduce the gear shift table and to modify the trace data file, using a specific application from the software package;
- The test report generated by the software was not informing the final pollutant gases values, in g/km. So, the software was reprogrammed to indicate the correct values;
- As the MVEG test is performed in only one phase and its total sampling volume exceeds the volumetric capacity of each pair of bags, an analysis to define the bags shifting was made. Two pairs of bags were necessary to sample the entire ambient and exhaust gas volumes. The shifting was set to occur between “part one” and “part two”, establishing one pair of bags for each cycle part. The final result for each pollutant was calculated by summing “part one” and “part two” mass results, in g, and dividing it by the total distance, in km, performed in the test.

The laboratory technical team solved the above mentioned issues with the equipment supplier technical support.

5. Emission Tests with Argentinean Driving Cycle and Possible Correlations to Brazilian Emission Test

After the MVEG driving cycle implementation, the laboratory was able to run the necessary emission tests with the new premium gasoline. Six vehicles were selected: five were available in Brazil with the same requirements from the Argentinean market; one was brought from Buenos Aires. Four of the available vehicles in Brazil were imported from Europe and preserved its original characteristics to be commercialized in both countries. The remaining vehicle is produced in Brazil and exported with the same requirements to Argentinean market.

Bellow, are listed some points that would be correlated between the cycles:

- The implementation of the Argentinean driving cycle will able the company to make a correlation between FTP-75 and MVEG (or NMVEG) results in the future. This correlation would be very useful to improve the MVEG emission and fuel economy results evaluation of PETROBRAS fuels, because the Vehicle Test Laboratory is very experienced in the FTP-75 cycle emission evaluation, including the influence of fuel composition on emission results. It would also indicate which of both driving cycle has more sensitivity to evidence differences between two fuels. Preliminary tests, using just three vehicles with two different fuels were done as shown in Figure 3. To establish reliable correlations between the driving cycles it would be necessary to test more vehicles and fuels;

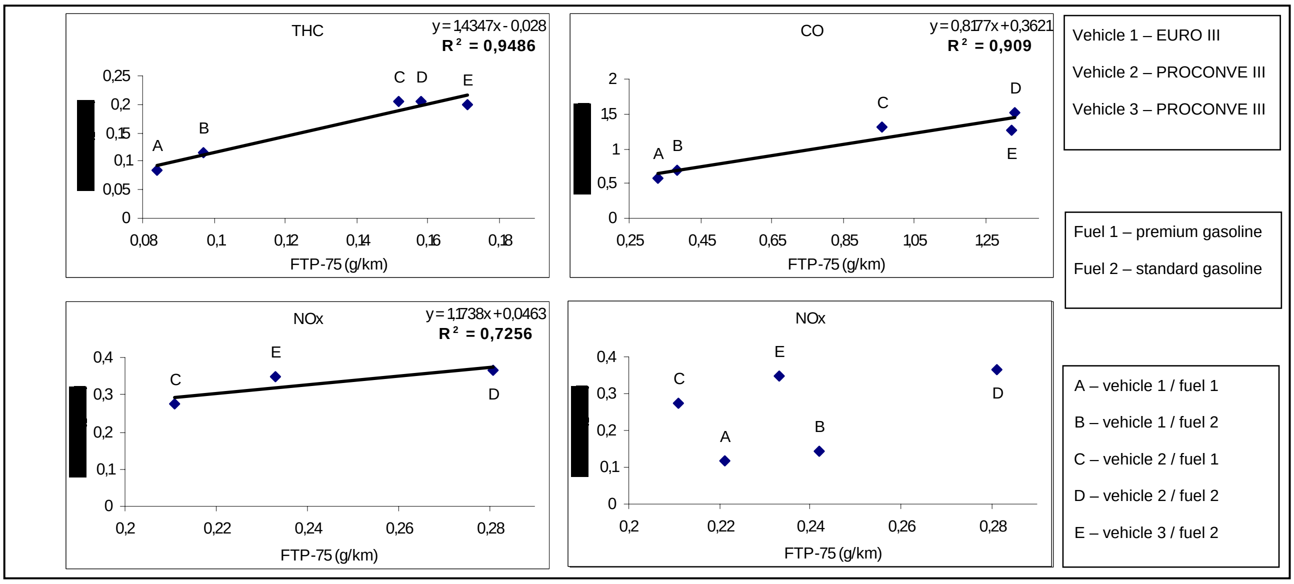

Figure 3 – Preliminary FTP-75 and MVEG correlation results.

-THC and CO presented good correlation coefficients between FTP-75 and MVEG results, for the three tested vehicles (R^2>0,9). These gases values, in g/km, were higher when performed the MVEG driving cycle. Concerning NOx emission results, vehicles 2 and 3 also presented higher values with MVEG, while vehicle 1 presented lower values running the same cycle (points A and B). One factor to explain it, may be a specific calibration and a catalyst design to accomplish NOx EURO III limits (0,15 g/km), running the European cycle. Excluding vehicle 1 results, it was found a reasonable NOx correlation coefficient between both cycles (R^2>0,7);

- MVEG driving cycle, in its initial part, submit the vehicle catalyst to lower temperatures, when compared to FTP-75. It makes the catalyst reaches its "light-off" temperature at later times. This difference between the cycles affects more vehicles with under floor catalyst configuration (vehicles 2 and 3) than vehicles with closed couple configuration (vehicle 1), due to the first configuration higher distance to the engine, and consequently higher times to reach the light off temperature. So, it would be done emission results correlations, regarding times to reach the light off temperature, driving cycles performed and vehicle catalyst configurations;
- The challenge of these correlations would be to know which of both driving cycles has more sensitivity to highlight influences of relevant gasoline properties, such as aromatics and sulfur, in emission results;
- These correlations would be also important to better the scope of the vehicle emission and fuel economy prediction tools in development by the company, allowing this kind of analysis to Argentinean vehicles and fuels. One correlation between FTP-75 and NMVEG was already published in a recent work (Biasso *et al*, 2003), with positive results for THC, CO and NOx.

In 2006, Argentina will change its driving cycle to the NMVEG. It will demand CENPES Vehicle Test Laboratory to reprogram its software that controls the emission tests, in order to eliminate the 40 seconds idling period before starting the sampling. In this new cycle the engine is turned on immediately after starting the test and the sampling, so cold start is accounted in the emission results. In this manner, it would be possible to study the influence of this new cold start procedure in emission results.

6. Conclusions

As shown in this paper, Brazil and Argentina present differences in its adopted emission limits, driving cycles and standard gasoline, following, respectively, U.S.A. and Europe legislations.

Concerning the emission limits, trends of reducing, mainly, HC and NOx emission, are observed in both countries.

The reference fuels in both countries are also aligned, searching for specifications that allow the attendance to the restrictive exhaust emission limits, foreseen in the respective countries legislations.

MVEG driving cycle was successfully implemented in the laboratory and the new premium gasoline development emission tests were performed satisfactorilly. Few adaptations will be necessary to allow the laboratory to perform the NMVEG cycle that will be adopted in 2006, in Argentina.

One manner to compare Brazilian and Argentinean driving cycles' is establishing correlations between its exhaust emission results. However, it would demand a big test program and it is not the focus of this paper. The presented correlation results used a small number of vehicles and fuels and may indicate only a trend. Future works will be possibly done, when CENPES Vehicle Test Laboratory owns a more complete MVEG / NMVEG data base to make these correlations.

7. References

CEE, 1970, "Directiva 70/220/CEE – Texto Consolidado, de 01/05/2004".

CNP, 1989, "Resolução CNP n° 1".

CEE, 1991, "Directiva 91/441/CEE".

CE, 1994, "Directiva 94/12/CE".

CE, 1996, "Directiva 96/69/CE".

ABNT, 2000, "NBR 8689 – Veículos rodoviários automotores leves – Combustíveis para ensaio – Gasolina, álcool e suas misturas".

ABNT, 2001, "NBR 6601 – Veículos rodoviários automotores leves – Determinação de hidrocarbonetos, monóxido de carbono, óxidos de nitrogênio e dióxido de carbono no gás de escapamento".

Secretaría de Ambiente y Desarollo Sustentable, 2002, "Resolucíon 1270/02 - Emissiones Contaminantes, Ruídos y Radiaciones Parasitas".

Biassio, M., 2003, "Regulamentação de Emissões Veiculares: a Alternativa Européia Comparada à Americana", Proceedings of SIMEA 2003.

IBAMA, 2004, "Programa de Controle da Poluição do Ar por Veículos Automotores – PROCONVE / PROMOT, http://www.ibama.gov.br/proconve/divs/manual_volumeI.pdf".

ANP, 2005, "Resolução n° 06/2005".

ANP, 2005, "Regulamento Técnico n° 02/2005".

8. Responsibility Notice