GLOBAL FUEL ECONOMY INITIATIVE

SUB-REGIONAL WORKSHOP
12-13 OCTOBER 2017

WORKING GROUP 2: ULTRA-LOW SULPHUR FUELS AND ENFORCEMENT

Venue: The Ravenala Hotel, Balaclava
Republic of Mauritius

Presented by: Akhilesh Ramkalawon

Structure of Presentation

- Background of vehicular fuels in Mauritius

- Possibility of introducing **Ultra-Low Sulphur Fuels** (ULSF)

- Results of **Ambient Air Quality Monitoring** carried our the National Environment Laboratory

- Enforcement against black smoke

- Recommendations

Background: Vehicular Fuels in Mauritius

- The **State Trading Corporation (STC)** is the responsible authority for the import of vehicular fuel;

- STC sets out the specifications for the quality of fuels to be imported;

- Consignments of **petrol (Mogas RON 95)** and **diesel (Gas Oil)** are presently procured from Mangalore Refineries and Petrochemicals Ltd (MRPL), India.

Background: Evolution of Fuel Quality in Mauritius

Year	Improvement in fuel quality
1992	Lead content in petrol was reduced from 0.84 g/l to a maximum of 0.4 g/l
2001	Sulphur content in diesel was reduced from 5000 to 2500 ppm
2002	**Unleaded petrol** was introduced and made mandatory
2010	Sulphur content in diesel was reduced from **2500 to 500 ppm**
2012	Sulphur content in diesel was reduced from **500 to 50 ppm**

Working Group 2: The Process

8 local stakeholder institutions involved

- **Chair and Team Leader**:
  Ministry of Environment
- **Members:**
  Ministries responsible for:
  1. Land Transport (National Transport Authority & Mechanical Engineering Division)
  2. Finance
  3. Commerce

  State Trading Corporation
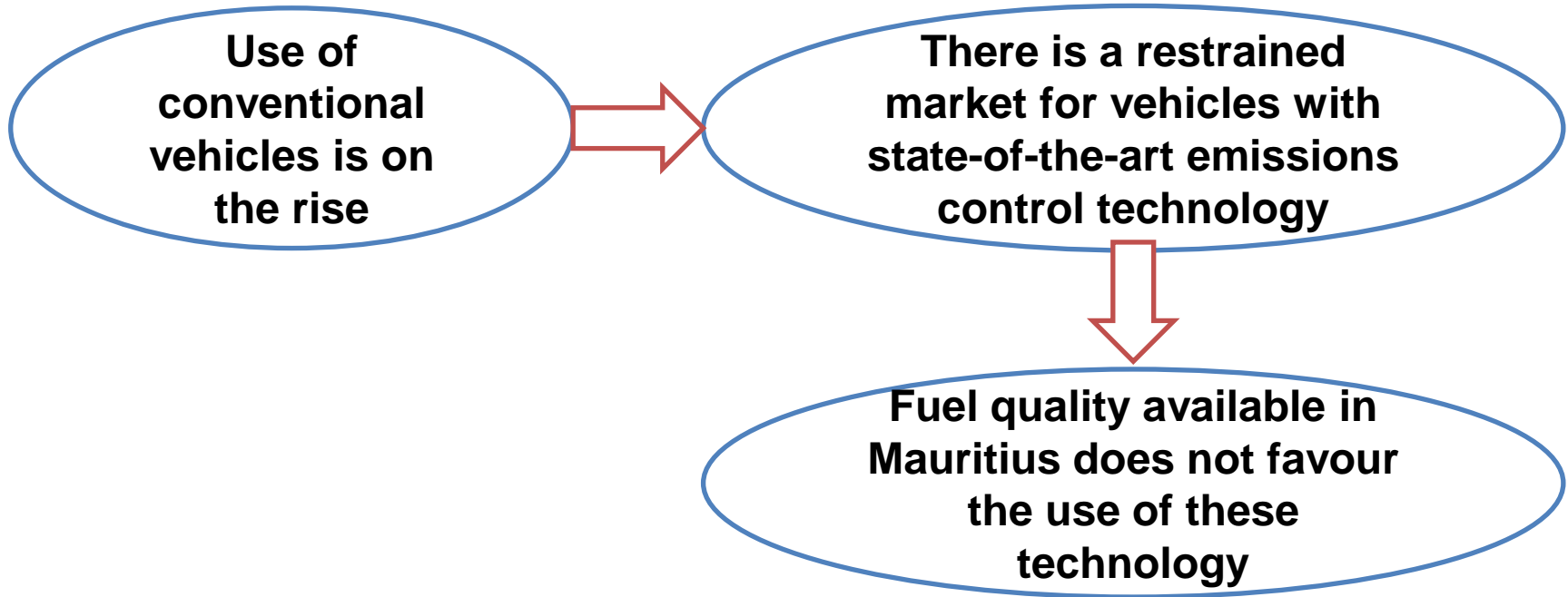
  Mauritius Police Force

  Mauritius Revenue Authority

  Mauritius Institute of Training and Development
- **Technical Secretariat and Coordination**: Ministry of Environment

Terms of Reference

No.	Terms of Reference	Methodology
1	To look into the possibility of introducing ultra-low Sulphur fuels (ULSF).	Multi-stakeholder discussions at WG level
2	To make proposal for the type of emissions control technologies which can be used.	Desk review
3	To monitor impact of vehicular emissions on ambient air quality.	Ambient air quality monitoring by NEL
4	To make proposals to tackle black smoke emissions from vehicles	Multi-stakeholder discussions at WG level

Rationale

Use of conventional vehicles is on the rise → There is a restrained market for vehicles with state-of-the-art emissions control technology

Fuel quality available in Mauritius does not favour the use of these technology

- To **improve fuel economy** and **reduce pollution** from vehicles, one of the first step is to make efficient use of the existing technology by using **ULSF**.

Assessing Vehicular Fuel Quality

Parameters assessed:

• Sulphur content in diesel and petrol; and

• other harmful constituents such as benzene, aromatics and polycyclic aromatic hydrocarbons (PAH).

Comparison based on:

1. STC specifications;

2. Actual levels;

3. International Standards and guidelines: e.g. Worldwide Fuel Charter (WWFC)

STC Specifications v/s International Guidelines

The Working Group has compared STC specification for Petrol and Diesel with that of:

1. the Worldwide Fuel Charter (WWFC)

2. European Standards;

3. Indian Standards; and

4. Japanese Standards.

We have used **WWFC** as a benchmark to compare the fuel quality in Mauritius as it caters for the compounds being addressed.

Comparison of Diesel Quality with WWFC

Parameters		WWFC Categories				
		1	**2**	**3**	**4**	**5**
Sulphur Content (ppm)	WWFC	2000	300	50	10	10
	STC Specifications	-	-	**50**	-	-
	Actual consignments	-	-	**20 – 40**	-	-
Total Aromatics % (m/m)	WWFC	N/A	25	20	15	15
	STC Specifications	**Not specified**				
	Actual consignments	**No test carried out to determine level Aromatics**				
PAH % (m/m)	WWFC	N/A	5.0	3.0	2.0	2.0
	STC Specifications	**Not specified**				
	Actual consignments	**No test carried out to determine levels of PAH**				

Sources: STC (2016) and WWFC (2013)

Comparison of Petrol Quality with WWFC

Parameters		WWFC Categories				
		1	**2**	**3**	**4**	**5**
Sulphur Content (ppm)	WWFC	1000	150	30	10	10
	STC Specification	**1000**	-	-	-	-
	Actual consignments	-	**Ranged between 17 to 51**		-	-
Benzene % (v/v)	WWFC	5.0	2.5	1.0	1.0	1.0
	STC Specification	**5.0**	-	-	-	-
	Actual consignments	-	**1.2–2.44**	-	-	-
Aromatics % (v/v)	WWFC	50.0	40.0	35.0	35.0	35.0
	STC Specification	**Not specified**				
	Actual consignments	**Inferior to category 1 (53% v/v)**	-	-	-	-

Sources: STC (2016) and WWFC (2013)

Issues with Current STC Specifications for Petrol

STC specifications for Sulphur: **<1000 ppm**

Current Sulphur content in consignments: **17-51 ppm**

- The current STC specifications do not allow the import of better and energy efficient vehicles.

- STC specifications need to be changed to enable the amendment of vehicle emissions standards with better and up-to-date ones;
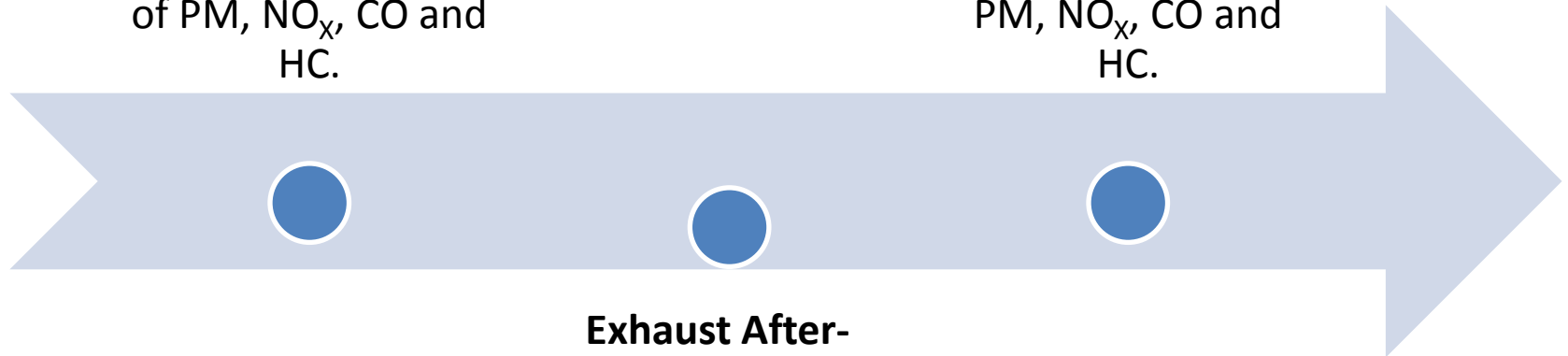
Exhaust After-Treatment Technologies

Dirty Exhaust From Engines

Exhaust containing high concentrations of PM, NO_X, CO and HC.

Treated exhaust

Exhaust containing reduced amount of PM, NO_X, CO and HC.

Exhaust After-Treatment Technologies

Harmful emissions are treated

For maximum reduction of PM, NO_X, CO and HC, **ULSF is required**.

Impact of Vehicular Emissions on Ambient Air Quality

- Monitoring carried out by the **National Environmental Laboratory**

- **Locations**: hotspots such as busy roadsides and bus terminals

- **Duration**:

  - 18 January 2012 to 08 February 2012;

  - 07 November 2012 to 22 November 2012;

  - 14 March 2013 to 28 March 2013;

  - 14 September 2016 to 28 September 2016

Results of Monitoring along a Busy Street

| Monitoring period		PM_{10} (µg/m³)	NO_2 (µg/m³)		SO_2 (µg/m³)		CO (µg/m³)
		24-hour average	1-hour average	24-hour average	1-hour average	24-hour average	1-hour average
Before LSD	18 Jan 2012 – 08 Feb 2012	36.5 – 60.2	-	0.0 – 30.2	0.3 – 127.9	4.5 – 24.5	0 – 7,427
After introduction of LSD	07 – 22 Nov 2012	39.6 – 68.6	-	14.5 – 36.8	0.03 – 20.64	1.57 – 7.66	0 – 5,064
	14 – 28 Mar 2013	-	-	24.9 – 40.2	0.0 – 83.8	4.0 – 17.8	116 – 8,382
	14 – 28 Sep 2016	-	-	5.5 – 45.7	1.9 – 35.4	3.2 – 14.6	0 – 5,937
Environment Protection (Standards for Air) 1998 (µg/m³)		100 (24-hour average)	-	200 (24-hour average)	350 (1-hour average)	200 (24-hour average)	25,000 (1-hour average)

Source: Computed data from NEL

2016 Monitoring Result along a Busy Street (1)
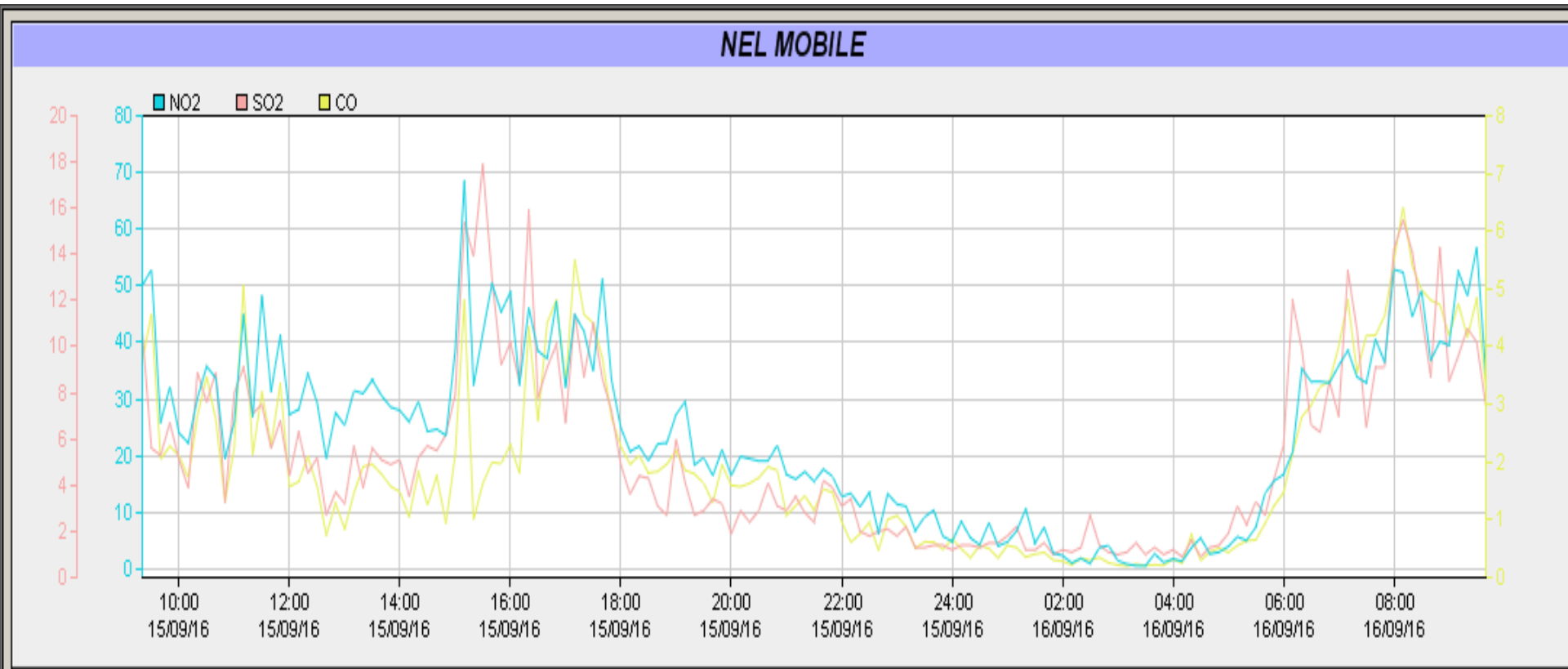
Results of Ambient Air Quality Monitoring at SSR Street, Port Louis (15-16 September 2016)
Source: NEL (2016)

2016 Monitoring Result along a Busy Street (2)
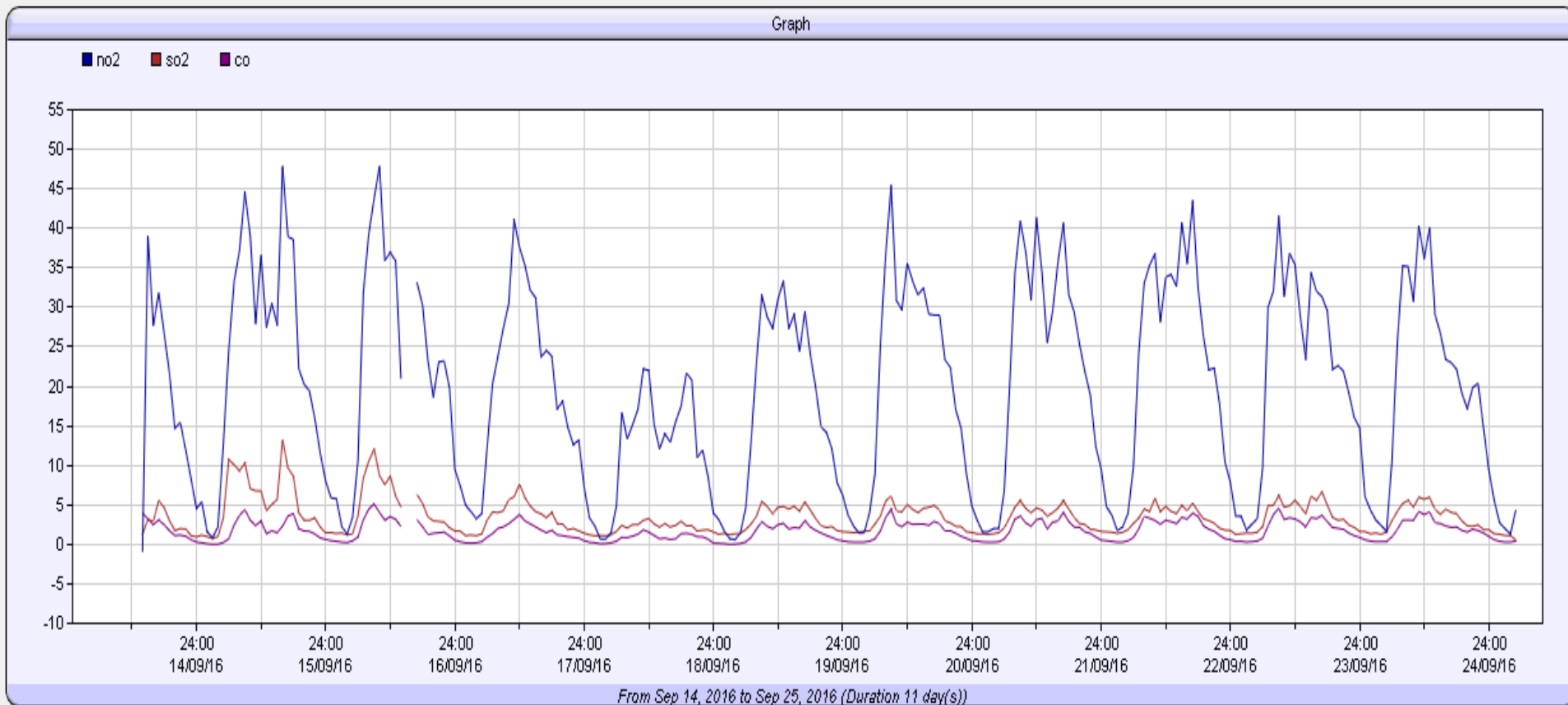
Results of Ambient Air Quality Monitoring at SSR Street, Port Louis (14-24 September 2016)
Source: NEL (2016)

Monitoring in the Vicinity of a Bus Terminal

Parameters	Results (maximum values) ($\mu g/m^3$)	Environment Protection (Standards for Air) Regulations 1998 ($\mu g/m^3$)
SO_2	39.1	350 (1-hour average)
CO	1,397	25,000 (1-hour average)
NO_2	23.9	200 (24-hour average)
PM $_{10}$	29.4	100 (24-hour average)

Source: NEL (2016)

Network of Fixed Ambient Air Quality Monitoring Stations

Results of monitoring of PM_{10} carried out from 20 August 2015 to 21 August 2016 were as follows:

1. In Port Louis : **13.92 μg/m³** (yearly average)
2. In Vacoas : **14.04 μg/m³** (yearly average)

The results for PM_{10} were within the WHO Air Quality Guidelines of **20 μg/m³** and that of the draft National Environment Standards for Ambient Air Quality.

General Conclusions on Air Monitoring

All parameters measured namely PM_{10}, NO_2, SO_2 and CO complied with the Environment Protection (Standards for Air) Regulations 1998 and **the results were well below the limits during the monitoring exercises**.

Enforcement

- Legislation governing vehicle emissions**: The Road Traffic (Control of Vehicle Emissions) Regulations 2002**

- Enforcement against smoke emissions carried out by:

  1. Police de l'Environnement (Roadside visual checks for mainly black smoke)

  2. Vehicle Examination Centres (privatized and fully equipped)

- It has been observed that main polluter are buses and badly maintained HDVs.

Recommendation 👍

Recommendations on Fuel Quality

- Review fuel specifications for both diesel and petrol by giving consideration to Sulphur as well as benzene, aromatics and polycyclic aromatic hydrocarbon.

- The Working Group recommended that STC imports diesel and petrol with **10 ppm sulphur content as per Category 4 guidelines of the Worldwide Fuel Charter**.

Implications of Recommendations on Fuel Quality

Better fuel quality will enable:

- the review of the legislation governing emissions standards from vehicles by making it more stringent; and

- the import of vehicles with state-of-the-art emission control technologies to curb down vehicular pollutants.

Recommendations on Ambient Air Quality Monitoring

- Setting up of **Ambient Air Quality Monitoring stations** at strategic locations to monitor levels of vehicular pollutants.

- Considering the use of Ambient Air Monitoring pods for street profiling of air pollutants along busy streets.

Recommendations to Address Vehicular Black Smoke Emissions

At Government level:

- Procuring user-friendly smoke meters for enforcement (e.g. having wireless technologies);

- Enhanced enforcement with trained and equipped personnel;

- Mandatory use of buses meeting EURO III emissions standards;

- The enforcing agency for land transport to look into the possibility of monitoring real-time vehicular emissions using Remote Sensing Devices

Recommendations to Address Vehicular Black Smoke Emissions

At Bus companies level:

- Possess adequate number of smoke meters (in good conditions) as per existing legislations to monitor black smoke from buses;

- Conduct daily checks and regular maintenance of vehicles;

- Import buses with better engine quality; and

- Provide continuous professional development of personnel.

Sensitisation against Vehicular Black Smoke Emissions

A video clip has been prepared to sensitise people, particularly diesel vehicle users, about black smoke emissions, the need to maintain their vehicle regularly and the fines associated to it.

Thank You