Cairo Air Improvement Project
Vehicle Emissions Testing Component

Management Manual for Vehicle Emissions Testing Centers

Chemonics International, Inc.
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Executive Summary

The primary purpose of the program management manual is to provide a basic understanding of model centers. A second use for the manual is to serve as non-technical training material for new employees.

As introduction to the aims of model centers, the manual provides background information on the organizations responsible for establishing model centers throughout Greater Cairo, and a briefing on the laws followed, namely the directives of Environmental Law 4/1994 (concerning emission standards) and Traffic Law 66/1973. In addition, the manual introduces the three phases of the Memorandum of Understanding (MOU) between the State Ministry of Environment (MOE) and Ministry of Interior (MOI), which has initiated the vehicle emissions testing/tune-up program.

A central part of the manual deals with the model center. In a procedural description of the center's activities, this section is based on information supplied by the original equipment manufacturer. It is a necessary element for training management staff and other personnel.

It is to be noted, however, that the program management manual is a non-technical training guidebook intended for use in conjunction with other technical manuals.

The manual consists of 7 chapters. Chapter 1 outlines the Cairo Air Improvement Project (CAIP) and its major stakeholders. Chapter 2 contains a technical explanation of vehicle emissions types and reasons. Chapter 3 introduces the cooperation agreement between the Egyptian Environmental Affairs Agency (EEAA) and MOI, while Chapter 4 briefly outlines the tune-up program and its phases. Vehicle emission control, measurement methods, and VET station methodology are the subject of Chapter 5. Of direct concern to management, Chapter 6 shows the proposed organization chart of the Model Station. Finally, Chapter 7 deals with a very important component in managing the centers: customer relations.

Chapter One:
CAIP and its Stakeholders

Introduction

CAIP was initiated in August 1997 under the supervision of EEAA, and is funded by USAID. The project aims to mitigate pollution in Greater Cairo air, especially harmful exhaust gases, and particulate matter and lead that have serious impacts on public health.

Air pollution sources can be divided into two main categories: stationary sources, and mobile sources. CAIP focuses on mobile sources such as cars and buses, but also deals with some stationary sources, mainly lead smelters.

Chemonics International Co. runs the project. Its staff, including technical experts and consultants, work closely as a team with their Egyptian counterparts to provide technical assistance, training, and modern equipment according to annual work plans to achieve the following goals:

- Reduce harmful vehicle emissions and increase engine efficiency through enforcing vehicle validity tests whereby its exhaust emissions are inspected and its engine may undergo a tune-up process before the vehicle obtains an exhaust validity certificate.
- Reduce the emissions of diesel-fueled buses, which emit particulate matter into the air, through increasing the number of buses using compressed natural gas (CNG) as fuel.
- Mitigate air pollutants such as lead and other materials that result from smelters throughout Cairo.
- Establish a special program for air quality monitoring to record the improvement of air resulting from CAIP's activities.

CAIP also runs public awareness campaigns and evaluates other initiatives to reduce air pollution.

EEAA Overview

EEAA was initiated under the Cabinet in accordance with the Environmental Law No. 4/1994, to replace the former Environmental Agency established by the Presidential Decree No. 631/1982.

EEAA outlines general policies, develops plans for environmental protection and development, and monitors their implementation. It is entitled to undertake experimental projects.

EEAA is the concerned national entity to consolidate environmental ties between Egypt and global and regional organizations and countries.

In order to achieve its goals, EEAA assumes the responsibilities to:

- Prepare draft laws and decrees relevant to its goals
- Prepare studies of the environmental status and develop national plans for environmental protection and associated projects
- Set up standards and terms that project and facility owners should comply with before construction and during operation
- Set up standards and percentages to ensure permissible pollutant limits are not exceeded
- Periodically gather data of national and global environmental status and related changes
- Set up the basis and procedures to mitigate negative environmental impacts of projects
- Develop environmental emergency- and environmental training plans, and supervise the implementation of both plans
- Participate in developing and implementing the national program of environmental monitoring and benefit from resulting information
- Develop public awareness programs and support their implementation
- Coordinate with other bodies to regulate handling of hazardous materials
- Manage and supervise natural protectorates and follow up the enforcement of international and regional environmental agreements
- Carry out pilot projects to preserve natural resources and protect the environment against pollution
- Register national institutions and qualified entities that participate in environmental protection programs, and coordinate with the Ministry of International Cooperation to ensure that the projects funded by donors are in line with environmental safety criteria

- Participate in developing a national plan to manage the coasts of the Red Sea and the Mediterranean
- Participate in developing a plan to protect the country from hazardous wastes
- Develop an annual report of the status of the environment for presentation to the President and the cabinet

EEAA's Board of Directors consists of the Environmental Minister as chairman, and the Executive Director of EEAA as board member and deputy chairman. Represented in the Board are the ministries concerned with the environment, environmental experts, non-governmental organizations (NGOs), the State Council, the Public Enterprise Sector, universities, and scientific research centers.

An Environmental Protection Fund is established under EEAA, to contain the government's allocated sum, donations of national and international organizations, fines and indemnification for environmental damages and the revenue of protectorates fund. The fund revenues are to be used to achieve its goals.

EEAA offers incentives to entities and individuals that carry out acts or projects to protect the environment.

CAIP Components

CAIP consists of four technical components in addition to the component responsible for public awareness campaigns and evaluation of other initiatives to reduce air pollution:

1. Vehicle Emissions Testing (VET)
2. Compressed Natural Gas (CNG)
3. Lead Pollution Abatement (LPA)
4. Air Quality Monitoring (AQM)

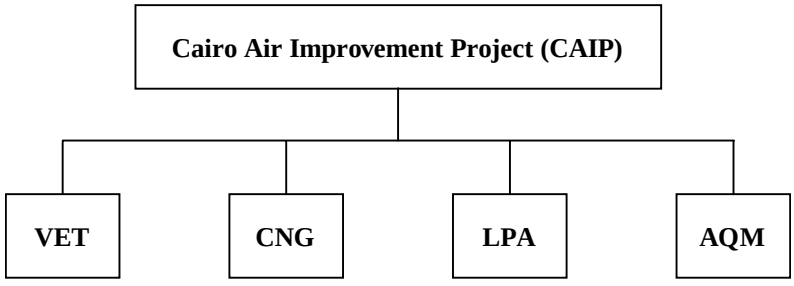


Figure 1–1: Major Components of CAIP

Details of the role and activities of each component appear below.

1. VET

The Environmental Law No. 4/1994 states that vehicle emissions must comply with emission standards with the aims to reduce harmful emissions, such as carbon monoxide, which have serious impacts on public health. To enforce the law, as well as improve engine performance and increase fuel efficiency, VET comprises two activities:

- Vehicle emissions testing and measurement
- Tune-up of engines emitting harmful emissions

Routine vehicle emissions testing, initially under the supervision of CAIP, will later be a requirement prior to license issuance.

According to the traffic department's statistics of April 1998, there are 1,154,057 vehicles moving about the streets of Greater Cairo. Table 1–1 shows the details of this number distributed over the three governorates and the various vehicle types.

Table 1–1: Vehicles in Greater Cairo

Item	Private	Taxis	Buses	Motorcycles	Lorries	Other	Total
Cairo	539,044	64,564	15,967	99,013	97,177	650	816,415
Giza	190,626	34,757	4,578	40,578	39,385	240	309,658
Qalioubiya	5,700	7,000	464	7,000	7,500	320	27,984
Total	735,370	106,321	20,503	146,591	144,062	1,210	1,154,057

Figure 1–2: Car undergoing a vehicle emissions test

2. CNG

Compressed Natural Gas (CNG) is among the cleanest vehicle fuels, as its burning produces a small amount of harmful emissions. The CNG component aims to reduce vehicle emissions through increasing the use of CNG in fueling bus fleet in Greater Cairo.

Natural gas is composed of several gases, mainly methane. Egypt is among the major countries with large amounts of high-quality reserve of natural gas, hence should turn its attention to it as alternative fuel. CAIP's CNG team will cooperate with Cairo Transit Authority (CTA) and Greater Cairo Bus Company (GCBC) to promote CNG usage in public transport buses, by equipping the bus fleets with engines specifically designed for CNG.

The Ministry of Petroleum and the Organization for Energy Planning (OEP) supervise this activity. CAIP will provide Misr Lab, the engine-testing laboratory of Misr Petroleum Co., with modern equipment to test the emissions of these buses. Figure 1–3 demonstrates a CNG bus.

Figure 1–3: A CNG bus

3. LPA

The aim of the Lead Pollution Abatement Component is to reduce lead pollution in the ambient air. Studies of the air in Cairo showed airborne particles to be the most serious pollutant and most dangerous one to public health.

Smelters all over Cairo are the primary source of lead pollution for both smelter workers and residents of neighboring areas.

Estimates indicate that lead smelter workers are exposed to over 100 times the internationally permissible limits.

CAIP's LPA team activities comprise:

- Develop a design for an environmentally sound complex to house private-sector lead smelters, using modern technology
- Provide technical assistance for small and medium smelters and smelter licensing units
- Develop and execute a long term national plan to combat lead pollution

4. AQM

The aim of the Air Quality Monitoring Team is to develop a complete system for monitoring the quality of ambient air in Greater Cairo.

The system will register the particulate matter in the air and the percentage of its components, including lead, through a network of 36 monitoring stations distributed across Cairo. This includes 6 local meteorology stations. The network aims to monitor the change in the quality of air hence record the improvement due to the efforts of CAIP and the Government.

In addition to the aims of its four components, CAIP aims to handle the data obtained through an automatic geographical data network and record the data periodically to observe changes.

CAIP's efforts complement the efforts of EEAA and the Danish International Development Agency (DANIDA), who together started in 1996 the design of a 14-station network for air monitoring distributed across the country. The three entities will provide training for Egyptian experts on air monitoring, and registration and analysis of data.

Chapter Two:
Types and Causes of Harmful Emissions

Introduction

Vehicles are the primary source of air pollution. They contribute about 60% of carbon monoxide (CO), 50% of hydrocarbons (HC), and all the quantities of nitrogen oxides (NOx), polluting the air.

Emissions of vehicle engines include:

- Crankcase emissions, which are the gases that leak during combustion to the crankcase carrying oil vapors emitted due to increased temperature
- Vapors from the fuel tank and fuel cycle components
- Gases resulting from burning of fuel

How Vehicle Engines Pollute the Air

Gasoline fueled engines are the main source of pollution, as they emit the highest levels of CO, HC, and NOx. They also emit small quantities of sulfur oxides. On the other hand, diesel fueled engines emit higher quantities of sulfur oxides, but less of the other pollutants. This might come as a surprise, considering the visibility of the diesel engine's exhaust as opposed to that of gasoline engines, but this visibility is attributed to particles in the form of smoke.

Pollution from Gasoline Engines

Gasoline fuel consists of several hydrocarbons (compounds of carbon and hydrogen). For a complete burning process, 1 kg of gasoline requires 14.7 kg of air, as burning involves a reaction between the gasoline (i.e., HC) and the oxygen found in air to produce water (H_2O) and carbon dioxide (CO_2). The above ratio of fuel to air (1:14.7) is the target ratio to ensure maximum efficiency and economy in engine operation.

The ratio of air to fuel is expressed as a parameter whose symbol is (λ, or Greek letter lambda). When the ratio of this mixture is ideal, the value of λ is 1.04, and the reaction that takes place is:

gasoline (HC) + air (oxygen + nitrogen)⇨carbon dioxide + water + nitrogen

If air is more than fuel (a *poor* mixture; λ>1.04), burning results in oxygen as well. In this case, the reaction is as follows:

gasoline (HC) + air (oxygen + nitrogen)⇨carbon dioxide + water + nitrogen + oxygen

If fuel exceeds air (a *rich* mixture; λ<1.04), burning results in carbon monoxide, since there is not enough oxygen to form carbon dioxide. The quantity of carbon monoxide emitted depends largely on the air-fuel ratio (λ). The burning process in case of a rich mixture also emits unburned fuel (i.e. hydrocarbons). About 65% of such hydrocarbons are emitted from the tailpipe, 15% as vapors from the fuel tank and carburetor, and 20% as gases leaking from engine components.

When fuel burns irregularly or too quickly in the combustion chamber, a loud noise (knocking and explosion) is heard inside the engine. Additives are accordingly used to increase fuel efficiency and prevent such noise. The most important of these additives is lead ethyl, which results in non-organic substances emitted in the exhaust. Presently, unleaded gasoline is produced using alternative additives.

After fuel ignition by spark plugs, a very high temperature—sometimes exceeding 2000 degrees Celsius—is generated and results in chemical reactions, including a reaction between oxygen and nitrogen which produces nitrogen oxide (NO). The generated gas exits through the tailpipe to react with the outside air and form nitrogen dioxide (NO_2) then N_2O_2.

Incomplete fuel burning also results in NO and small quantities of sulfur oxides, mainly sulfur dioxide (SO_2), caused by oxidization of sulfur found in fuel due to improper refinement of crude oil.

Emissions from vehicle engines are, therefore, mainly:

1. Unburned hydrocarbons, e.g., paraffin, aldehydes, polymers
2. Carbon monoxide
3. Carbon dioxide
4. Nitrogen oxides
5. Sulfur oxides

6. Lead compounds (in leaded gasoline)
7. Water vapor (not harmful)
8. Smoke
9. Particulate matter
10. Odors

Pollution from Diesel Engines

Diesel engines produce less quantity of pollutants than gasoline engines except for sulfur oxides. Table 2–1 compares quantities of pollutants from the two engines.

Table 2–1: Gasoline vs. diesel engines

Pollutant	Gasoline engine	Diesel engine
Carbon monoxide	8.00	0.12
Sulfur oxides	0.016	0.03
Nitrogen oxides	0.25	0.08
Lead (if leaded gasoline)	0.01	–
Aldehydes	0.01	0.03
Unburned hydrocarbons	0.39	0.24
Percentage contribution	97.1 %	2.9 %

Source*: Environmental Protection circular, London, 1979*

Heavy black smoke emitted from diesel vehicles is composed of unburned hydrocarbons due to insufficient oxygen, especially at start-up.

Vehicle Emissions, Significance and Factors

Hydrocarbons

Hydrocarbons in vehicle exhaust should be reduced as much as possible, to less than 100 parts per million (ppm) for vehicles with a catalytic converter and 400 ppm for vehicles without one.

The quantity of hydrocarbons is the best indicator of engine performance. High HC indicates ignition or burning defect; it can reach 2000 ppm if there is an ignition defect.

The quantity of unburned hydrocarbons in the exhaust varies according to the air-fuel ratio. It also varies according to the spark angle (α): for λ<=1.3, HC increases with the increase of α, but, for higher λ, HC decreases with the increase of α. Figure 2–1 shows both relations.

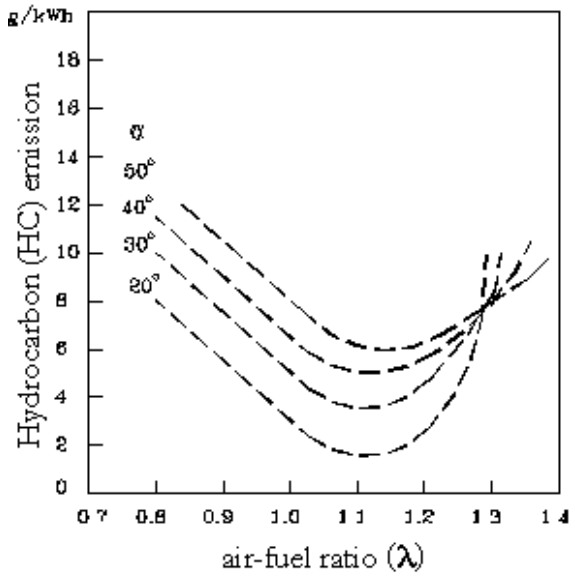


Figure 2–1: Relation between hydrocarbons and air-fuel ratio (λ)

Moreover, the quantity of unburned hydrocarbons in the exhaust depends on the position of spark plugs in the ignition chamber. Emissions increase when spark plugs are in the side position and decrease when they are in a central position.

Carbon Monoxide (CO)

The quantity of CO varies according to λ in the following manner: For λ < 1, they are inversely proportional, for λ > 1, the variation is insignificant (very small or non-existent). The quantity of CO also depends on the spark angle (α). CO must be minimized: it should be below 0.5% in newer engines and approximately 2.5% in old engines. Figure 2–2 shows the relation between CO and air-fuel ratio (λ).

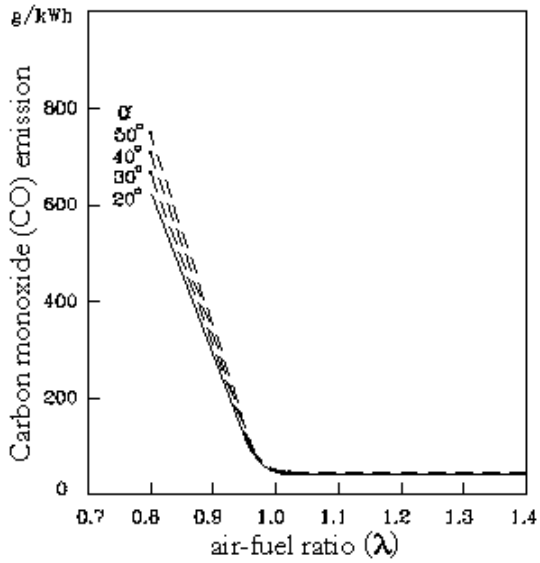


Figure 2–2: Relation between CO and λ

Nitrogen Oxides (NOx)

The percent of NOx in exhaust varies according to the value of λ, as shown in figure 2–3. It also increases with the increase in the value of α.

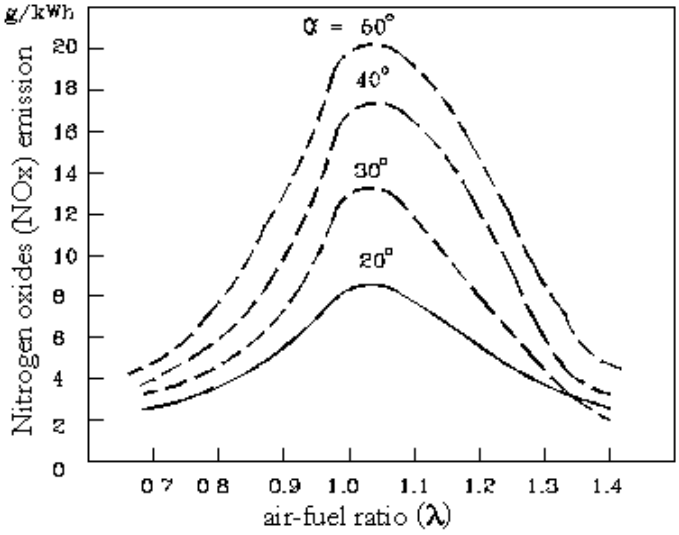


Figure 2–3: Relation between NO_x and λ

Effect of Gasoline Engine's Operating Conditions on Pollutants

Table 2–2 shows the rate of emissions resulting from gasoline engines under different operating conditions.

Table 2–2: Effect of operating conditions on emissions in gasoline engines

Data	Idle Speed	Acceleration	Constant Speed (Long distance travel)	Deceleration
- Air-fuel ratio	1:12.5	1:13	1:15	1:12.5
- Engine speed, in revolutions per minute (rpm)	400–500	400–3000	1000–3000	3000–4000
Emission analysis				
- CO percentage	4–6%	0–6%	1–4%	2–4%
- NO (mg/liter)	10–50	1000–4000	1000–3000	10–50%
- Hydrocarbons (ppm)	50–100	50–500	200–3000	4000–12000
- Unburned to burned fuel	4–6%	2–4%	2–4%	2–6%

Source*: Environmental protection laws issued in Los Angeles during the period 1972–'76*

Tables 2–3 and 2–4 show possible the reasons that could account for high quantities of hydrocarbons and carbon monoxide.

Table 2–3: Possible reasons for increased hydrocarbon emissions

CO emissions associated with large quantities of HC	Possible reasons for emissions (engine trouble)
CO quantity reasonable or low (note that unburned HC is unburned fuel)	1. No ignition (insufficient spark plug clearance or damaged wires). 2. Timing adjustment not correct (too advanced), improper timing of contact breaker opening/closing, or contact-breaker points are damaged. 3. Poor air-fuel mixture (too much air). 4. Air leakage from around chambers to crankcase or low pressure. 5. Leakage from exhaust valve, or oil chamber corrosion causing spark plugs to be saturated with oil. 6. Low idle speed. 7. Air-fuel ratio not proper: • Too rich: spark plugs saturated with fuel, incomplete burning. • Too poor: incomplete burning, engine fails to run.
CO in large quantities	1. Very rich mixture resulting from increase in fuel in carburetor or closure of ignition valve or air filter blockage. 2. Low idle speed. 3. Carburetor float not adjusted, possible blocking of idle-speed pick. 4. Fuel is absorbed into crankcase through its ventilation valve. 5. Carburetor needs repair or replacement, if its cleaning does not eliminate problem.

Table 2–4: Possible reasons for increased carbon monoxide emissions

HC emissions associated with large quantities of CO	Possible reasons for emissions (engine trouble)
HC in reasonable or small quantities	1. Very rich mixture (fuel quantity needs adjusting, pick not clean, increase of fuel level in float chamber, or partial closure of start-up valve). 2. Blocking of vacuum valve or crankcase ventilation, or existence of fuel in crankcase. 3. Air filter not clean
HC in large quantities	1. Engine does not run: • Spark plug clearance not adjusted, no spark, or leakage in exhaust valves • High-pressure wires or spark plugs damaged, ignition timing not adjusted, or contact-breaker clearance not proper 2. Very rich mixture resulting from increase in fuel level in carburetor, start-up valve closure, or air filter blocking. 3. Fuel absorption into crankcase through its ventilation valve.

Guidelines for repairing diesel engines

The opacity of smoke emitted from cars due to increase in quantity of smoke may be a result of different engine troubles, tune-up error, or internal engine damage. Technicians should therefore be familiar with proper maintenance and tune-up operations as well as maintenance procedures provided by the engine manufacturer. There may be some difficulties with older diesel engines related to their compliance with standard levels of smoke opacity. Below are some general guidelines for the repair of diesel engines.

- Ensure that the ventilation system is not blocked.
- Check the timing of the injection pump.
- Check for any internal leakage in or damage to the injection pump.
- Ensure that fuel does not flow out of injectors.
- Check that injectors comply with standards.
- Check for damage to injectors in addition to corrosion in internal parts of the engine.

When repairing vehicles emitting high levels of pollutants, it has to be put in mind that the goal of repair is to decrease emissions as much as possible. This implies

first checking for increase in fuel level in the carburetor or closure of the start up valve before tuning up the idle speed in the carburetor.

Emissions should also be tested and measured after maintenance and repair operations and final measurements must be recorded.

Vehicle Emissions Control Methods

Hydrocarbons are the result of unburned gasoline and vapors from simple evaporation. This means that a car could pollute the air even when it is not running.

It was found that, for vehicles manufactured before the late sixties, 20% of hydrocarbon emissions result from fuel evaporation. The burning of fuel inside the combustion chamber happens so fast that a layer of gasoline that does not burn would form on the combustion chamber edges. These gases are pushed behind the compressor during normal operation of the engine and accumulate in the crankcase, then typically exit to the ambient atmosphere through the air coming in from the oil filter cap. The ventilation tube was cancelled in 1961, causing crankcase vapors to be drawn into the combustion chamber to be burned. This "closed" crankcase ventilation system, which uses a positive ventilation valve, is shown in figure 2–4.

In addition, hydrocarbons emitted from the engine tank and carburetor were eliminated by collecting the vapor into a storage box—a small box containing a filter made of charcoal—that would later feed the carburetor during engine operation. Preliminary emission control methods focused on reducing CO and HC through improving combustion during engine tune-up, accomplished by using less concentrated fuel and having fuel burning at high temperatures.

The air-fuel ratio is the chief factor in determining vehicle emission quantity. Increasing this ratio (less concentrated fuel) reduces CO and HC emission, and leads to more efficient fuel consumption. These measures, however, increase NO_x, which requires relatively high energy for nitrogen to unite with the ambient air oxygen at high temperatures. Additionally, excess oxygen required for more complete combustion leads to increased formation of NO_2 then N_2O_2. To reduce NO_x, pressures and temperatures should be reduced. This is achieved through delaying ignition spark time to prevent burning from occurring at maximum air/fuel pressure. Yet, fuel efficiency in this case is reduced.

Increasing engine efficiency without increasing emissions became possible since 1975, by using catalytic converters, which reduce CO and HC emissions after

combustion by their reacting with oxygen on the converter's surface. To maintain converters—which are expensive, unleaded, low-octane gasoline should be used.

To reduce NO_x to a minimum, exhaust gases are recycled to dilute the incoming mixture of fuel and air, which in turn reduces the maximum temperature during combustion, thus minimizing NO_x formation. This could be compared to throwing wet wood into a blazing fire. This system is called "exhaust recycling" and is composed of valves that control the quantity of exhaust gases fed back.

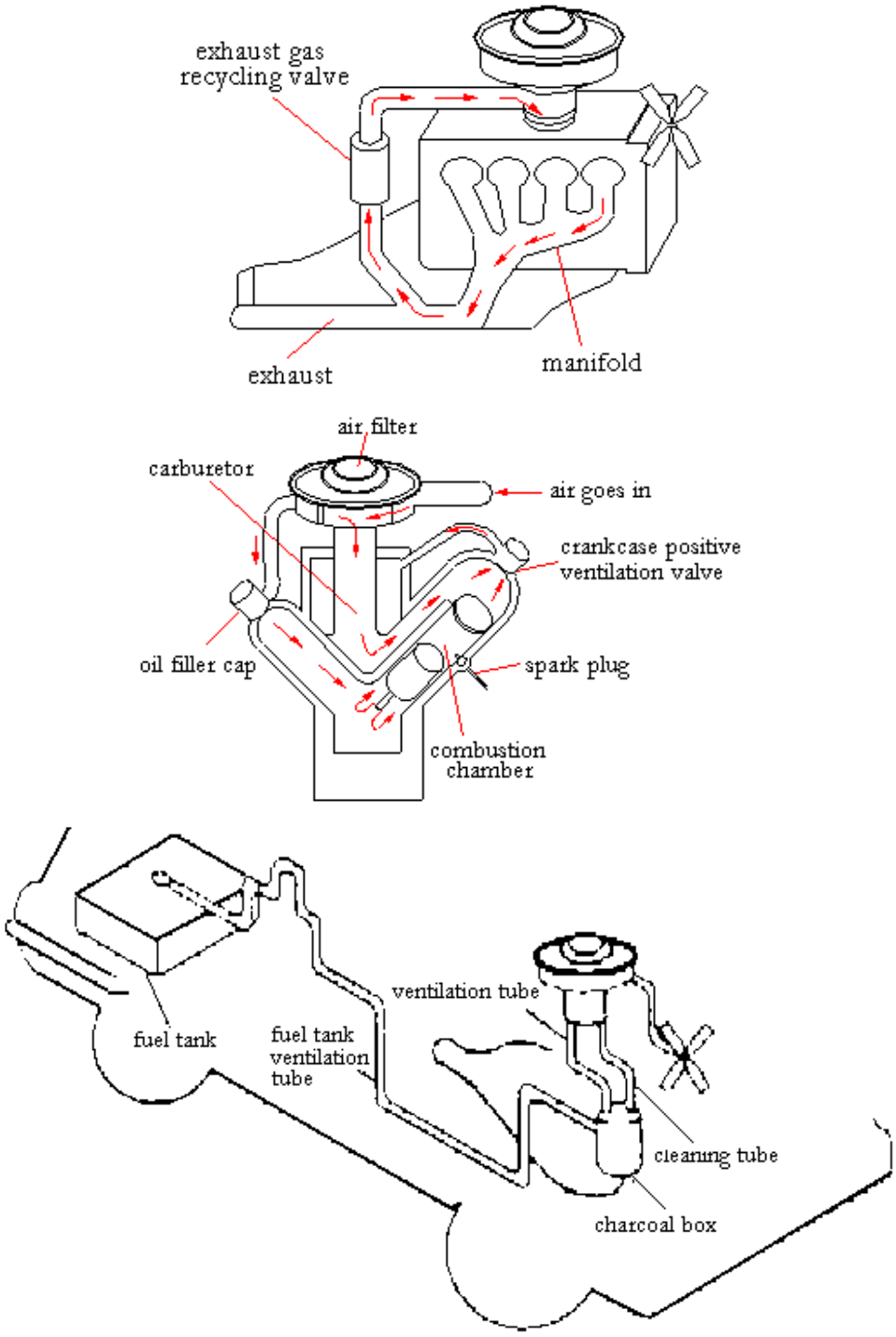


Figure 2–4: Some Methods of Car Emissions Control

Chapter Three:
Cooperation Agreement between MOE and MOI

Introduction

In implementing the plans of the government of Egypt (GOE) to combat the problem of air pollution caused by vehicle emissions, the Ministry of State for Environmental Affairs (MOE) and the Ministry of Interior (MOI) have agreed to take the necessary measures to resolve this type of environmental pollution. Particular interest is given to mitigate pollution resulting from vehicle emissions that affects the population of Cairo. This comes in the context of the State initiatives towards a better environment.

Accordingly, a cooperation agreement was signed between MOE and MOI. The agreement is based on Traffic Law No. 66/1973 and its Executive Regulations, and Environmental Law No. 4/1994.

As stated in the agreement, the implementation plan will be conducted in three phases, summarized below.

Phase 1

MOE will provide 30 mobile analyzers, in order to measure and analyze vehicle emissions. It will also provide the required technical staff to operate the analyzers, on loan basis to the General Traffic Department. Using the analyzers, the General Traffic Department and the local traffic departments in Cairo will do surprise inspection campaigns, where they perform tests and analysis of exhaust emitted by vehicles on the roads within their domain. Vehicles not complying with emission standards specified by laws will be subject to license withdrawal.

Phase 2

EEAA will establish 3 model centers for vehicle technical inspection and emission testing (VET) distributed in locations to cover the 3 governorates of Greater Cairo (Cairo, Giza, and Qalioubiya). These centers should be duly equipped with modern facilities for safety inspection as well as exhaust emission testing. Each center will be staffed with at least one officer and one engineer from the traffic department of the concerned area. The role of the staff would be to supervise the technical inspection as detailed in the Traffic Law and its Executive Regulations. EEAA will supervise the emission testing.

Establishment of the model centers should be followed by issuance by the Minister of Interior of the necessary executive decrees to enforce Article 37 of the Executive Regulations of the Environmental Law (Law 4/1994) within 60 days as of the three stations' operation date. Such decrees should include the governorates in which the aforementioned article's provisions shall apply.

Phase 3

The main theme of this stage is to establish a whole network of inspection stations to extend VET throughout Greater Cairo for all types of vehicles. Tenders for building new VET centers in Greater Cairo will be open to the private sector, using the same specifications as the model technical inspection and emission testing centers.

Traffic Law No. 66/1973

When enforcing the On-the-Road-Testing (ORT) program, CAIP, EEAA, and the concerned traffic departments will abide by Traffic Law No. 66/1973 and its Executive Regulations until MOI issues a decree to enforce Environmental Law No. 4/1994 on all vehicles.

The Executive Regulations articles that are most relevant to vehicle emissions are articles Nos. 33, 72, and 74. Below is a summary of the regulations they embody.

Article 33

Traffic police is entitled to stop any vehicle that violates the conditions of safety and send it to the nearest traffic department to undergo technical testing. In case the vehicle fails the emissions test, its license shall be withdrawn along with the driving license.

Article 72

License shall be withdrawn for 30 to 60 days, or for the remaining validity period, whichever period is shorter, in the following cases:

1. Loads fall out of the vehicle
2. Hazardous materials leak from the vehicle, endangering roads or people on the roads

Article 74

Motorist shall pay a fine between £E 5–25 if the vehicle makes unusual sounds, emits heavy smoke, emits a bad smell, or hazardous or flammable material leaks from the vehicle.

Environmental Law No. 4, 1994

Below is a description of the article of this law that concerns vehicle emissions. This is article #37.

Article 37

It is not allowed to use equipment, engines, or vehicles that produce emissions exceeding the following maximum limits of its constituents:

Firstly: Vehicles older than 1995:

- Carbon monoxide:
  7% by volume at idle speed (600–900 rpm)
- Unburned hydrocarbons:
  1000 ppm at idle speed (600–900 rpm)
- Opacity of smoke:
  65% or equivalent at maximum acceleration

Secondly: Vehicles of model 1995 or later:

- Carbon monoxide:
  4.5% by volume at idle speed (600–900 rpm)
- Unburned hydrocarbons:
  900 ppm at idle speed (600–900 rpm)
- Opacity of smoke:
  50% or equivalent at maximum acceleration

This article is valid in the governorates named in a Decree to be issued by the Minister of Interior, which includes a grace period of one year to enable the owners of such equipment, machines, and vehicles to comply with the provisions of this article.

EEAA, in coordination with the ministries of Interior, Industry, Health, and Petroleum can review the maximum limits of this article after 3 years from the date of these Executive Regulations. Table 3–1 outlines the maximum permissible limits of vehicle emissions.

Table 3–1: Maximum permissible limits of vehicle emissions

Emission	Vehicles before 1995	Vehicles after 1995
Unburned hydrocarbons*	1000 ppm	900 ppm
Carbon monoxide*	7 %	4.5 %
Opacity**	65 %	50 %

* Emissions should be measured at the idle speed 600-900 rpm.

** The rate should be measured at full acceleration.

The enforcement of the environmental law is suspended waiting for the issuance of the Interior Minister of a decree to specify the governorates where the law will apply.

The environmental law therefore has not yet taken effect. The enforced law at present is Traffic Law No. 66/1973.

The Interior Minister's decree is expected to be issued after the completion of Model Centers mentioned in the phase two of the cooperation agreement between MOE and MOI.

Responsibilities of Phase One

The responsibilities of the first phase are distributed in two parts, for EEAA and the General Traffic Department.

1. Role of EEAA

EEAA is taking care of technical aspects as follows:

- EEAA provided 30 gas analyzers for vehicle emissions along with required technical staff.

- EEAA handed over the analyzers to the General Traffic Department, on temporary loan basis, according to the organizing regulations. Technicians to operate the analyzers are also delegated to participate in the surprise ORT campaigns in implementation of phase one of the cooperation protocol.
- EEAA organized theoretical and practical training for technicians on using the analyzers, filling the measurement results form, and explaining their role in ORT as well as explaining the articles of the Environmental and Traffic Laws that will be imposed throughout the 3 phases.
- Technicians will work 6 days a week on the roads assigned to them. EEAA shall designate one day for each technician to deliver to EEAA his weekly reports, with copies attached of measurement forms filled for tested vehicles.
- EEAA shall send the attendance schedule of technicians to the General Traffic Department to follow up the staff.
- Technicians should send their weekly reports to the General Traffic Department, EEAA, and CAIP.

2. General Traffic Department's Role

The General Traffic Department distributed the analyzers on the geographical locations stated below:

- For main entrances to Greater Cairo: 8 gasoline analyzers and 5 diesel analyzers. These will cover the inspection units on the main roads leading to the Greater Cairo, namely:
  - Cairo–Fayoum Desert Road
  - Cairo–Alexandria Desert Road
  - Cairo–Belbeis Desert Road
  - Cairo–Alexandria Agricultural Road
  - Cairo–Ismailia Desert Road
  - Cairo–Suez Desert Road
  - Cairo–Kattamia Desert Road
  - Cairo Ring Road
- For testing inside the city: 14 gasoline analyzers and 3 diesel analyzers were distributed on Traffic Departments in the Greater Cairo as follows:
  - Cairo Traffic Department: 5 gasoline + 1 diesel
  - Giza Traffic Department: 5 gasoline + 1 diesel
  - Qalioubiya Traffic Department (Shoubra El Kheima): 4 gasoline + 1 diesel

The program is evaluated every 3 months. Some analyzers may be relocated according to Traffic Departments needs provided EEAA is notified.

The role of the Traffic Department during phase 1 of the agreement includes:

- The General Traffic Department and Greater Cairo's traffic departments have started enforcing the Traffic Law No. 66. Violating vehicles are stopped by the traffic police who withdraws the license and gives a receipt valid for only 72 hours during which the vehicle must be repaired and tested again at any traffic department to ensure the cause of license withdrawal has been eliminated as per the provisions of Article 33 of the Traffic Law.

  If the vehicle is not repaired during this period, the vehicle license attached to test report shall be sent to traffic department issuing the license to impose the stated penalty and test the vehicle.

- The surprise ORT in Greater Cairo involved a sufficient number of vehicles and was not limited to vehicles emitting heavy, visual smoke, to collect data of all emissions whether visual or not and accordingly provide a measure for pollution to Cairo air resulting from vehicle emissions. Analysis of the collected data will render information useful in the 2nd and 3rd phases.

- The General Traffic Department supervises the organization and operation of the inspection staff, and determines working hours and locations of the campaigns on roads and inside Greater Cairo. Traffic departments monitor the daily attendance of technicians. The Road Department Director of General Traffic Department will supervise the implementation and can be contacted to coordinate between the involved parties.

Advertising Project Inauguration

EEAA and the General Traffic Department shall cooperate to organize a public awareness campaign promoting the start of implementation of the state plan to combat air pollution resulting from vehicle emissions. A main purpose of the campaign is to get the public opinion in favor of and later accept enforcement of the Environmental Law once the second phase of the project is completed.

What Comes after On-the-Road Testing?

During the second phase of its agreement with MOI, MOE will establish 3 model VET centers in Greater Cairo and issue validity certificates to tested vehicles.

The Minister of Interior will then issue a decree to enforce the Environmental Law. From then on, vehicle license issuance or renewal will include as a

requirement the submittal of the technical inspection form (No. 101-Traffic), which includes the chassis and engine serial numbers, and attachment to it is the validity certificate issued by the technical inspection center (emissions measurement center).

To follow up, a VET center has already been established in Shoubra El Kheima, in Qalioubiya Governorate. Two other centers will follow in Cairo and Giza.

Chapter Four:
Vehicle Tune-up Program

Introduction

Through its VET program, CAIP aims to reduce fuel consumption in addition to reducing emissions of vehicles by upgrading the tune-up facilities available to vehicles in Greater Cairo.

After completing the project, it is expected that one million vehicles will undergo inspection, and 1,200,000 vehicles will be tuned up annually in order to have them in compliance with the Environmental Law.

The tune-up program is to be implemented in three phases:

Phase One

This phase started in May 1998 upon the directives of the Minister of State for Environmental Affairs. Forty-one gas analyzers were implemented in 29 gas stations and 120 managers and technicians were trained on testing and tune-up operations.

Phase Two

Increasing the number of technicians working in gas stations is the main activity of Phase 2, aimed to follow-up with the vehicle emission tests conducted by EEAA inspectors at selected inspection points on the roads. Under the program, a team, comprising a traffic officer and an EEAA inspector, test vehicles and send those exceeding emission limits to repair workshops for repair such that they comply with Environmental Law No. 4/1994.

In this context, the CAIP project trained 25 mechanics on engine tune-up.

Phase Three

The main aim of this phase is to establish a network of repair workshops and service stations, and provide required technicians and necessary equipment to conduct the testing and tune up of the vehicles that do not comply with the Environmental law. The network should be extensive enough to meet the expected increase in the testing that will be achieved when the private sector has established the inspection stations network.

Chapter Five:
Monitoring Vehicle Emissions

This chapter is intended as a technical manual to familiarize employees at the inspection station with the typical processes and how they are conducted, and the terms and equipment used. It contains a guide to the inspection procedures to be used during the demonstration phase of the Greater Cairo Vehicle Inspection Program. It is also useful as an operations primer and reference for standard procedures and should be used as an aid for training inspection and management personnel.

All new employees should read this chapter carefully before and during their work at the inspection station. Experienced employees should use this manual as a reference when needed and may refer to it every now and then to ensure their familiarity with its contents.

System operations consistency can be guaranteed only by conformance to procedures described in this manual.

This chapter is divided into four sections:

1- **Introduction**: A brief overview and a glossary of equipment and terminology.
2- **Inspection Equipment**: Description of how to operate the emissions inspection equipment.
3- **Inspection Tasks**: A detailed breakdown describing *how to* perform each task in the inspection process, *what* tasks to be done, and the sequence of tasks needed to ensure proper inspection flow.
4- **Safety**: Description of the safety measures to follow when inspecting a vehicle and when working at a vehicle inspection station.

Introduction

The introduction includes an overview of the inspection process and a glossary of equipment and terminology used. The glossary is useful initially as an introduction to terms used throughout this manual and later as a reference during the employee's assignment at the inspection stage.

Overview

The Cairo Air Improvement Project (CAIP) has developed a Vehicle Emissions Testing (VET) program in order to provide periodic emissions testing of the motor vehicle fleet operating in the Greater Cairo area. Agencies of the Government of Egypt contribute to various aspects of this program. The VET program measures exhaust emissions on passenger cars, trucks and motorcycles. In addition, a vehicle inspection of various components including an automated brake and side-slip alignment test will be provided. A Vehicle Emissions Report (VER) and an optional visual inspection report will be provided for vehicles that pass the relevant portions of the test.

Program Coverage

The program geographical domain includes the Governorates of Cairo, Giza and parts of Qalioubiya. The traffic departments currently providing vehicle registration services will be the basis for the area break-up into zones. A three-station *pilot* program will be initially implemented.

Following the period of operation of the pilot program, private sector VET service providers will be awarded the testing franchise for one or more zones and will perform the test and inspection certification process at test-only, high throughput facilities. All vehicles registered at a particular traffic department will be required to regularly undergo testing at the appropriate franchise location(s) for that department.

Pilot Program Implementation

The program will be initially implemented with three pilot stations, one in each Governorate of the program area. The stations will be equipped to provide emissions testing in each lane and safety.

Electronic communication with and transmission of data from the different stations and tests to the host, located at the technical center of EEAA, will be

possible only when the network is operational and the host communication is adequately supported through local suppliers.

Types of Tested Vehicles

Gasoline and diesel powered vehicles (including motorcycles) registered in Greater Cairo (Cairo, Giza and parts of Qalioubiya) will be tested for emissions in several stages. A list of the systems and grouping of vehicles selected for the pilot test will be prepared.

Test Procedures

The current law defines the pass/fail standards for vehicle emissions at idle speed that are shown in Table 5–1 below. The test procedure will hence measure HC and CO concentrations at idle speed (600–900 rpm) for gasoline powered vehicles to determine whether the vehicle passes or fails. Diesel vehicles will be tested for exhaust opacity during a *snap acceleration*, or free acceleration test. All motorcycles will, at a later stage of the program, undergo the test at idle speed with an additional exhaust opacity check on two-stroke powered machines. All contractors will perform the same test using the same emissions analyzers and opacity meters provided through CAIP.

Emission Standards

The standards for HC, CO and particulate matter/visible smoke will be based upon the statutory requirements as defined by Law No. 4/1995 (Article 37). Currently, the decree defines two model year groups and specifies allowable emissions for each as shown in the table below.

Table 5–1: Maximum allowed amounts of emission components

Pollutant	Model Year	
	Pre 1995	1995 and after
Unburned hydrocarbons*	1000 ppm	900 ppm
Carbon monoxide*	7%	4.5%
Opacity**	65%	50%

*: Measured at idle speed, i.e. at 600-900 rpm

**: Measured at maximum acceleration

Note: It is likely that a third category will be added in the near future for newer models. Additionally, a separate set of standards may be defined for

2-stroke vehicles, issued in a ministerial decree before initiation of the official implementation of the test program. For the purpose of the test, idle speed shall be limited to an engine speed between 400 and 1200 rpm.

Safety Standards

Vehicles subject to safety inspection will receive a combined visual/functional inspection of the components and systems. The brake system will also be automatically tested. A Vehicle Inspection Report form (VIR) will be printed for each safety inspection performed. The system software enables lane inspectors to perform a combined emissions test and safety inspection during the same visit to the station; thus enabling customers meet their registration renewal requirements in a one-time, drive-through service.

Standards for safety inspection are based upon the statutory requirements of traffic law No. 66/1973. An appropriate Ministerial Decree will be necessary for specifying the test measurements for brake and side-slip testing of vehicles that are to be included in the program.

Compliance Enforcement

To enforce the emissions inspection hence law compliance, the Traffic Departments of Greater Cairo will not issue or renew a license for vehicles that do not pass the mandatory test. The issuance of a test report at the test-only facility will allow the vehicle owner to proceed with registration at the appropriate Traffic Department office. Report forms will be provided for the test.

Test Charges

During the pilot phase, testing services will be provided free of charge to the motorist. Policies and procedures concerning payment for tests in the ongoing inspection have not yet been determined.

Quality Control

The testing equipment will contain internal audit systems and accuracy checks. Additionally, automated data processing equipment to compile and analyze test results will be provided at the EEAA Technical Center for program evaluation by EEAA.

Current traffic-department practices will remain unchanged for provisions of quality control during vehicle safety inspection. Furthermore, the automated data

collection system employed in the testing program will enhance these capabilities through the generation of standard reports available for personnel oversight.

Quality Assurance

Training programs will be developed under supervision of EEAA to provide employees with adequate information to ensure test safety. The data processing system will be modified to provide oversight capabilities and ease of access and usage to GOE personnel. The system will include a host computer system, to be located at the EEAA Technical Center, on which data from individual vehicle tests and other station operational information will be saved.

Operation Procedures

For gasoline-powered vehicles the test will include an automated measurement of the exhaust gas for CO and HC content. In addition, a visual pre-test observation for excessive smoke may warrant initial opacity testing which could fail the gasoline-powered vehicle before exhaust gases are measured. For diesel-powered vehicles the test will include an automated measurement of the exhaust opacity. For 4-stroke motorcycles, the test will include an automated measurement of the exhaust gas for CO and HC content, and—at the lane inspector's discretion—a visual check for smoke opacity similar to that applied for gasoline vehicles. For 2-stroke powered motorcycles, the test will comprise measurement of CO and HC content and opacity at idle speed using appropriate apparatus. A visual check of the fuel filter-cap mating will be performed on all vehicles.

Vehicle identification information will be manually entered from standard credentials issued by the Traffic Department. Data on vehicles, owners and earlier tests will not be automatically available beforehand till electronic communication with the main host at EEAA Technical Center has been established. Vehicle and owner data and test results will be stored on computers at the lane and station to be later transferred to the host computer system. Once this latter is operational and connected with stations via data lines, information on previous tests will be available from the host system for subsequent tests and it will not then be necessary to enter this information manually except for information on new cars.

A vehicle safety inspection will be performed on subject vehicles. It will consist of a visual inspection of the vehicle and a performance test of its parts, cycles, and system especially the brake system. Results of safety inspection will be recorded based on operator entries at either position one or position two.

Test Lane Functions

Figure 5–1 shows the configuration of a single test lane. Each lane consists of three sequential positions. These positions are:

- Position 1: vehicle-data entry, some elements of the vehicle safety inspection
- Position 2: emissions measurement (tailpipe and filler cap)
- Position 3: remaining elements of vehicle safety inspection, brake test, side-slip test, data storage, and a printout of the two reports (Vehicle Inspection Report: VIR, and Vehicle Emissions Report: VER)

The lane configuration is based on a design using commercially available PCs specifically tailored to meet the testing requirements of its assigned operating position within the test lane. These computers are linked to specialized test equipment used in performing all portions of the test sequence.

The position one lane inspector will enter vehicle information and any payment receipt data via the keyboard/display. The inspector will select the test type(s) based on the fuel used in the vehicle. The system then identifies the proper test for the vehicle to take at position two. Manual entry of all necessary data is required for a vehicle coming into the test station for the first time. In subsequent visits of the vehicle, earlier data may be retrieved from the host computer when the latter is operational. Prompting messages and earlier results will appear on the display screen in the latter case.

For lanes configured to test both emissions and safety, the ability to enter the vehicle safety inspection results is also available to the operator. The inspector at position one has the option to inspect as many of the items as time allows. The remaining items not inspected at position one, along with the brake and side-slip tests, will then be handled at position three.

Figure not available

Figure 5–1: General layout for test lanes

All prompts during data entry will be in Arabic. Several menu options are available when needed to facilitate the data entry process. To further simplify data entry, a database is installed for repetitive information such as car make and model, thus reducing data entry in some fields to selection from lists. All information will undergo data type, format and validity checks.

A preliminary pre-inspection check will be performed at position one to ensure vehicle safety. The lane inspector will visually check for leaking fluids (gas, oil, coolant, brake fluid, etc.), presence of a fuel filler cap, excessive engine noises, or smoke and will verify the integrity of the exhaust system. If there are safety concerns over these issues, i.e. a vehicle does not comply with safety standards; the vehicle may be rejected and not permitted to undergo testing.

At position two, the lane inspector will be prompted to perform the appropriate test based on the vehicle/fuel type. For gasoline-powered vehicles, the lane inspector will be able to initially run a pre-screening for opacity if he observes excessive smoke from the vehicle exhaust. Failure of this test will result in rejection of the vehicle prior to exhaust-gas measurement. For diesel-powered vehicles, the lane inspector and vehicle operator will together perform the snap-acceleration test, with the system providing useful prompts to ensure the test is conducted correctly. The vehicle operator will then be prompted to accelerate the vehicle till the required rpm reading is reached, with the system informing the inspector in cases of failure in attaining the required rpm in a suitable duration. Only three correct snap accelerations will be recorded by the automated system.

At position three, the emissions test results will be calculated and the VER automatically produced on a pre-printed VER form. All results printed on the forms will be in Arabic. Brake test, side-slip test, and remaining safety inspection items not carried out at position one will also be performed and their results entered onto the computer. Safety inspection results will be automatically calculated and the VIR printed on a standard VIR form. The test results are saved onto the computer.

Glossary of Equipment

Computer Terminal

Computer component through which data pertaining to vehicles is entered onto the computer, and prompting messages during tests are viewed. Comprises a microcomputer, keyboard and monitor and is located on top of the EMS cabinet.

Emissions Measurement System (EMS)

All the emissions testing components. Enclosed in a cabinet housing.

Emissions Analyzer

EMS component that measures percentage of hydrocarbons (HC), carbon monoxide (CO) and carbon dioxide (CO2) in vehicle exhausts.

Zip Driver

Device used to store data as an additional copy (backup) for the data stored onto the hard disk.

Host Computer

The main computer system located at EEAA's Technical Center. Contains a vehicle information database. The host computer collects daily inspection data from all stations for reconciliation and produces a variety of reports.

Monitor

Display screen of the computer.

Printer

Device connected to the computer to print reports such as VIR.

Sampling System

EMS component that takes a sample of the exhaust gas from the tailpipe, filters it, and enters the filtered sample at a specific rate into the emissions analyzer.

Test Cue Monitor (TCM)

Inspection lane display monitor. Prompts the inspector and enables the customer to observe the inspection process.

Glossary of Terminology

Air Pollutant

Any particulate matter, any gas/vapor other than water, or any combination of these that is emitted to ambient air.

Air Quality

An indication of the amount of pollutants contained in the air. Pollutants affecting air quality in general are hydrocarbons, carbon monoxide, oxides of nitrogen (NOx), sulfur oxides, particulate matter, and photochemical oxidants.

Boot

The process of starting up the computer.

Carbon Dioxide (CO_2)

An odorless, colorless, incombustible gas. Passes from lungs during respiration. Produced commercially. Absorbed by plants during photosynthesis.

Carbon Monoxide (CO)

An odorless, colorless gas produced as a result of incomplete burning of fuel. May be produced during improper burning of coal, oil, gasoline, or natural gas.

Centralized Inspection Program

Vehicle inspection system that is composed of inspection stations operated by either the government or a sub-contractor of it.

Certificate of Compliance

Certificate issued (lower section of VIR) that indicates compliance with emission standards of the vehicle identified on the certificate.

Gross Validation

Verification that data entered are correct and compatible with one another.

Cursor

Blinking indicator that appears on the display to mark the location of the next character or field to be keyed in.

Employee Number

An identification number assigned by the company or EEAA to each employee. Must be entered onto computer terminal to start its operation.

EEAA

Acronym for "Egyptian Environmental Affairs Agency." The governmental body responsible for protecting the environment in Egypt. Concerned with air and water pollution, solid waste disposal, pesticide manufacture and usage regulation, environmental radiation, and hazardous substances.

Exhaust Cone

A heat resistant rubber adapter used to extend the tailpipe and ensure a minimum of 25-cm probe insertion into the tailpipe.

Exhaust Emissions

Substances emitted into the atmosphere from any opening downstream from the exhaust outlets of a motor vehicle engine.

Facility Test

Test used to perform operational check on equipment. Used by maintenance department or station management.

Field

Data space used to hold information. Length of a field varies depending on information entered into it (e.g. vehicle identification number, year, make).

Hydrocarbons (HC)

Substances emitted with vehicle exhaust. Considered pollutants when emitted in large amounts into the air. This term stands for compounds composed only of carbon and hydrogen, mainly resulting from unburned/crude petroleum oil. Hydrocarbons also react with oxides of nitrogen (NOx) in the presence of sunlight to form photochemical oxidants.

Idle Speed

Engine speed of a motor vehicle—measured in rpm—in the case when the accelerator pedal is released, the engine is at normal operating temperature, and accessories (air conditioning and/or heater) are off.

Idle Test

Performing emission inspection when the vehicle's engine is at idle speed (typically 600–900 rpm).

Initial Test

The first complete inspection performed on a vehicle during any timeframe.

Inspection Lane

Area in inspection station where vehicle emission inspections are performed.

Inspector Badge Number
Three-digit identification number assigned to each station employee.

Mandatory Test
An inspection required for vehicle registration and license renewal purposes.

Manufacturer's Idle Speed Specification
Engine's idle speed specified by manufacturer for a particular motor vehicle. Printed on the emissions systems data plate in the engine compartment, or in the vehicle's owner manual.

Ozone
Photochemical oxidant, O_3, that may result from a reaction between HC and NOx in presence of sunlight.

Pass/Fail Cut-points
Maximum allowable levels for each tested pollutant (HC, CO) independently.

Parts per million (PPM)
Unit to measure quantity of solid particles in gaseous elements. Measures parts per million by volume. Hydrocarbons are measured and registered in ppm.

Probe
Steel portion of sampling hose that is placed into the tailpipe of the vehicle.

Purge
Process through which the emissions analyzer and sampling system is cleaned (purged) of a vehicle's exhaust sample.

Retest
Repeating the VET for a certain vehicle that has already had an initial test.

Revolutions Per Minute (RPM)
Unit of measurement for engine's crankshaft speed, i.e. the number of times it rotates in one minute.

Subsequent Test
All inspections performed after an initial test.

Validation
Verification that a single data entry is correct.

Vehicle Inspection Report (VIR)
Report printed for each fully tested vehicle.

Vehicle Identification Number (VIN)
Identification number assigned to each vehicle by the manufacturer. Consists of up to 25 characters that represent such information as model year, gross vehicle weight and engine size.

Vehicle Test Record (VTR)
Data created once a vehicle is inspected. Includes vehicle identification data, test results, and inspection time and location.

Inspection Equipment

Computer Terminal

The computer terminal consists of the following items:

- A keyboard, which is the standard 101-key unit. Several keys are used in the inspection and testing processes.
- A monitor, which displays test and vehicle information during inspection.
- A computer (PC), which monitors and controls the emissions test, transmits data to and from the host computer, coordinates the vehicle test record, and prints the VIR.

Keyboard Functions

Described below are the keyboard keys used to enter data onto the system or accept default data (which is the data that initially appears in a field, usually the most common choice, intended to simplify data entry).

Alt
Used with other keys to modify the purpose of those keys. Should be pressed at the same time as the other key whose alternative function is required.

Arrow keys (up, down, left, right)
The cursor may be moved up or down and left or right by depressing the appropriate direction (arrow) key.

Backspace
Moves the cursor one character backward within a field and erases that character, when no field is highlighted. Erases all the field's entry when the field is highlighted.

Note: To remove the highlighting of a field, press any direction key.

Caps Lock
When set on (i.e. light indicator is on) causes all subsequent characters entered to appear in upper case (capital). Must be set on when entering data.

Enter
Causes PC to accept all data entered on current screen, advances cursor to next screen, and starts emission test after all data entry is complete.

Character Keys
Some menu items designate certain letters, which, when pressed with either the Tab or an arrow key, will move the cursor to a desired choice. In some cases the Alt key must be held down while depressing a letter key to make a selection.

Tab
The tab key must be depressed to advance the cursor to the next field from a field in which the length of data entered is shorter than the field length. Note that the cursor will automatically advance to the next field—without pressing the tab key—if the current entry is the same length as the field.

Emissions Measurement System (EMS)

The EMS is a complete unit that controls all test functions. It takes the vehicle exhaust sample and analyzes that to determine whether the vehicle passes or fails; then processes the results. The inspection results are recorded and sent to the host computer, when available, and a VIR is printed.

Printer

The printer functions automatically once all inspection functions have been satisfactorily completed. All printer settings and controls are preset.

Inspection Tasks

This section explains the various inspection tasks in detail. The order of presentation follows the actual sequence of performing these tasks.

Pre-Test Procedures/Requirements

This section describes which vehicles are required to undergo inspection, what documents would be considered acceptable for vehicle identification, what to do if a vehicle presented for inspection is in an unsafe condition, engine changes, vehicle weight verification and early testing.

Vehicles that must be inspected
All non-exempt vehicles registered in the Greater Cairo area are required to undergo regular inspection (test frequency according to Traffic Department's regulations).

Acceptable documents
According to the traffic regulations.

Vehicle Rejection Procedures
Safety is a primary concern during the complete inspection cycle. Before beginning the inspection, you must determine if any unsafe conditions exist which could present problems during testing. Vehicles that are considered not valid for testing should be rejected and the motorist given a verbal explanation for the rejection in addition to a rejection form. Rejection criteria include, but are not limited to:

- Fuel Leak: to such a degree as to cause obvious wetness or pooling of fuel onto the floor. Fuel leaks can be detected by sight or by odor. **Be careful**.
- Fluid Leak: continuous leaking of engine oil, transmission fluid or engine coolant onto the floor.
- Improper Idle Speed: idle speed in excess of 1200 rpm (determined by the vehicle's tachometer or engine's sound), or idle speed so low that vehicle will not run without depressing accelerator pedal.
- Visible Smoke: excessive smoke for longer than five (5) seconds.
- Inaccessible Exhaust: probe cannot be inserted into exhaust due to physical or safety limitations (elbow's length from edge of vehicle), existence of two tailpipes, or presence of a net at the end of the tailpipe.
- Other Conditions: loud internal engine noises or other evidence that indicates possible major mechanical failure.

Note **All** reasons for rejecting a vehicle MUST be clearly listed by the station management. Under **no** circumstance will a vehicle be allowed to leave the premises without explanation of the rejection reason **and** a rejection form.

Engine Changes
According to traffic regulations.

Safety Procedures in the Station

This section outlines various station operations that involve health, welfare and safety, and provides guidelines for mandatory implementation and compliance. Employee and customer safety is the main concern.

Controlling Vehicle Exhaust

The necessity to minimize vehicular exhaust in inspection stations is constantly emphasized. The Station Manager must assume personal responsibility to ensure these guidelines below are followed hence provide maximum comfort to both employees and the public.

General Safety Guidelines

- Smoking is NOT permitted in the station. It creates fire and health hazards.
- No running, or acting irrationally. It can result in serious injuries.
- To maintain proper appearance and avoid snagging, or catching and tearing of clothing, possibly resulting in injury, always keep shirt tucked in.
- Whenever required to lift, push, pull, reach, bend, kneel, squat, or stoop, perform such actions without causing a strain on your body. Movements should be made slowly. Do not overexert yourself; get assistance from another employee when attempting heavier tasks. Keep your back upright; bend your knees instead when lifting things from the floor.
- When using a ladder, seek someone's help to stabilize the ladder.
- Only authorized personnel are allowed to open EMS cabinets and other enclosures to work on electrical/electronic equipment. Circuit breaker panels are not to be locked. Stacking and storage of material in the maintenance room must not block access to the circuit breaker.
- When equipment and/or locations are not in use, relevant doors should be kept closed to avoid potential electric hazards.
- All employees must know the location and use of all safety items such as fire extinguishers, first aid kits and emergency telephone numbers.
- Gas bottles must always be restrained in an upright position by a rope or chain. Do not attempt to lift a gas bottle.
- Gas bottles should not be moved or manipulated inside the station. They must be kept in the store and replaced from outside store door only.

Safety during Test Operations

- Vehicle occupants must be directed to wait in their vehicle. Do not allow customers to wander in the test lanes.

- Vehicle movement in lane areas presents a serious hazard. Drivers should be instructed to move vehicles slowly and only after all personnel are safely out of the way. Keep in mind that someone may be kneeling near a vehicle or in its path. Keep feet out of the path of vehicles.
- Ensure that all vehicle doors are closed before vehicles enter or exit stations.
- If it is necessary to hold the probe during the test, stand to one side of the vehicle, not behind it.
- Always look for vehicles before walking between lanes, when crossing in front of a lane entry, and/or upon entering/exiting the building.
- To prevent injuries from defective vehicles, careless drivers, or tripping over hoses and other objects, place probe hoses out of the way when not in use.
- Water should be removed from the floor and out the ends of the lanes during and at the end of rainy days. Floor drains shall be kept open and free flowing.
- Do not touch the tailpipe while placing the probe, and position yourself so as to minimize the possibility of exhaust fume inhalation. If exhaust fumes are inhaled and ill feeling results, notify station management immediately.
- Use caution around vehicle bodies. Sharp edges may inflict cuts, scrapes or bruises.
- Fluid leaks (oil, transmission fluid, etc.) on floor create slipping hazards which may lead to injuries. Clean up problem immediately.
- Gasoline leaks create fire and slipping hazards. If gasoline leakage occurs, have customer move vehicle out of facility. If excessive leakage occurs, turn off ignition and push vehicle out of station. Avoid walking in gasoline. Clean up gasoline immediately. Every effort should be made to prevent gasoline from entering the exhaust pits and floor drains. An approved absorbent material should be used liberally to control and absorb the spill. Water should not be used. Exhaust fans and blowers should be kept running to help dissipate fumes, heater should be turned off, and no smoking or open flames are permitted in the area.

Overheated Vehicles

Overheated engines, particularly during summer months, present serious hazards. The procedures below will be followed at all times in handling overheated vehicles:

- Do not open hood.
- If necessary, assist customer in pushing vehicle out of building or queue line.

Chapter Six:
Organization Chart of Model Stations

Introduction

To mitigate air pollution resulting from vehicle emissions and reduce their harmful impacts on road users, the State Plan includes the decision to face this problem through three executive phases, namely:

- Launching sudden on-road campaigns equipped with gas analyzers to test vehicle emissions.
- Setting up model VET stations to test vehicles technically and to measure their emissions.
- Expanding the VET station network to cover all areas of Greater Cairo.

Establishment of VET stations, including model VET stations, aims to ensure the enforcement of Article No. 37 of Environmental Law No. 4/1994. This article states the maximum permissible limits of vehicle emissions that must be met or the vehicle's license will be suspended.

The Environmental law is not yet enforced. It will be enforced only after issuance of the Minister of Interior's Decree that will name the governorates in which the aforementioned Article No. 37 would be applied.

The enforcement of this law is expected after completion of the three VET model stations (under Phase Two) and getting the public to accept the law. In order to prepare the public opinion to accept the law, public awareness campaigns will present the serious health impacts of vehicle emissions.

On enforcing the law, vehicle licenses shall be renewed only upon submission of a technical validity certificate (issued by the technical testing station containing the VET station) along with other currently required documents.

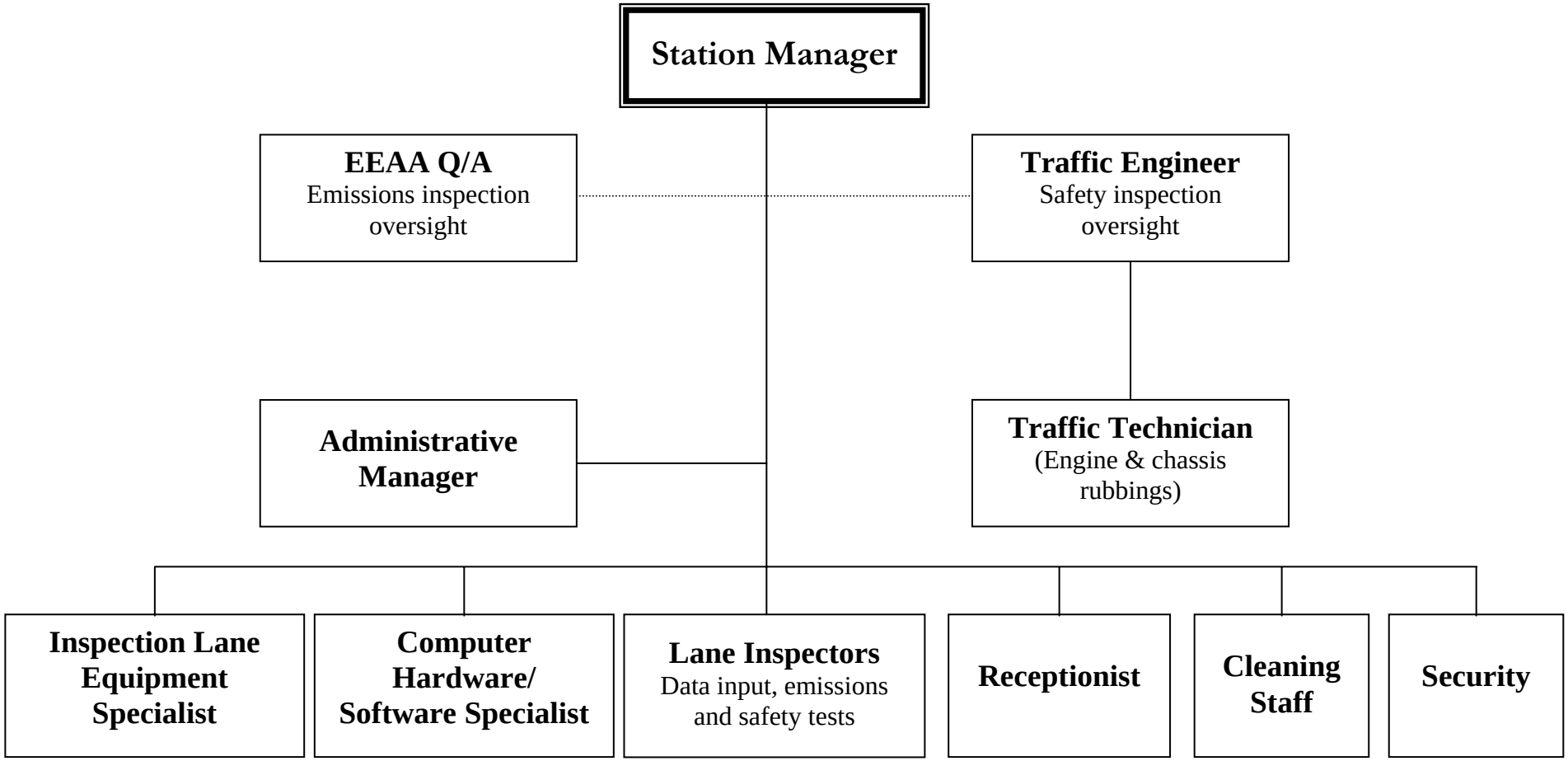
The validity of the vehicle shall be determined according to the result of the VET station's inspection. The credibility and success of program implementation

depends on the accuracy of testing procedures. Therefore, it is essential to provide well-trained and qualified staff to carry out the main tasks of the VET model stations. Those tasks are outlined in Figure 6–1 in accordance with the cooperation protocol between the Ministries of Environment and Interior.

The responsibilities and duties of the managers, inspectors, and staff of testing stations are outlined below. The concerned entities will determine the tasks and duties of both the VET Quality Control Inspector and Traffic Engineer.

Management Manual for VET Stations 6-3

Shoubra El Kheima Model Inspection Station
Phase II of the MOU
Organization Chart



Station Manager

Reports to Governorate and EEAA

Duties and Responsibilities

- Manage and coordinate the operation of the model inspection station during Phase II of the MOU and in accordance with the relevant policies and procedures of the Governorate and EEAA.
- Schedule work assignments to ensure proper staffing at different work volumes.
- Organize work assignments to ensure presence of Administrative Manager on site at all times of vehicle testing.
- Organize work assignments to ensure presence of EEAA's QA Inspector and Traffic Engineer on site at all times of vehicle testing.
- Assist in coordinating and conducting tours to the model station during Phase II of the MOU.
- Cooperate in providing test lane results to EEAA for research purposes.
- Provide training opportunities to each employee as well as periodic training programs whenever needed.
- Submit to the Governorate and EEAA regular weekly and monthly reports on operation, and normal and exceptional activities. Also submit regular weekly and monthly reports including all control facility forms, status reports on calibration gases, supplies and parts inventory.
- Coordinate general facility maintenance including grounds-keeping, janitorial upkeep and building maintenance and cleanliness.
- Perform basic maintenance and repair of inspection equipment, and oversee regular equipment maintenance schedule.
- Provide positive employee morale and ensure good public relations between employees and vehicle owners.
- Implement station's safety and training program, maximize safety measures, provide a safe workplace for all personnel and customers.

Administrative Manager

Reports to Station Manager

Duties and Responsibilities

- Handle all administrative duties of the model inspection station during Phase Two of the MOU in accordance with the Governorate and EEAA policies and procedures.
- Administer and control all forms and documents relevant to work operations in the facility, including calibration gases, supplies and parts inventory.
- Assist Station Manager in coordinating all staff tasks.
- Assist Station Manager in coordinating staff training.
- As scheduled and directed by the Station Manager, actively participate in supervising the inspection floor testing operations.
- Monitor lane operations including traffic flow, troubleshooting, and required rest periods.
- Ensure safety and protection for motorists and employees.
- Share accountability for all operations, including but not limited to: property/facility, equipment, work schedules, financial matters, etc.
- Ensure good public relations between employees and motorists.
- Assist Station Manager in preparing the station, grounds, equipment and inspectors for visitors and tours of the model station during Phase Two of the MOU.
- Perform other tasks as assigned by the Station Manager.

Test Lane Inspector

Reports to EEAA QA Inspector and Traffic Engineer

Duties and Responsibilities

- Pre-inspect vehicles to ensure safety and warm up engine.
- Direct vehicles in and out of the inspection facility, and perform inspection through each position of the inspection lane.
- Take data from motorist and input into computer in position # 1.
- Perform the vehicle emissions inspection according to policies and procedures specified in position # 2.
- Explain computer test results, and provide motorist with a report signed by Traffic Engineer.
- Maintain clean and proper appearance consistent with policies and procedures.
- Perform janitorial and station cleaning tasks as directed.
- Perform other tasks as assigned by EEAA's QA Inspector and the Traffic Engineer.

Computer Hardware/Software Specialist

Reports to EEAA's QA Inspector and the Traffic Engineer

Duties and Responsibilities

- Perform routine diagnostics, maintenance and repair of computerized systems of emission analyzers and safety equipment, and office computers following set schedules.
- Assist in installation, testing, and calibrating lane equipment and office computer systems and network.
- Report on assigned work and complete maintenance requirements.

Inspection Lane/Mechanical Equipment Specialist

Reports to EEAA's QA Inspector and the Traffic Engineer

Duties and Responsibilities

- Perform routine diagnostics, calibration, and repair of emission analyzers, safety equipment and other lane machinery following set schedules.
- Assist in installation, testing and calibration of inspection lane equipment and tools.
- Perform hardware repair and maintenance of all inspection equipment, and other station mechanical equipment such as air conditioners.
- Complete necessary paperwork, report on assigned work, and record data in maintenance and calibration records, reports and other documents.
- Manage special projects and perform other tasks as required by EEAA's QA Inspector and the Traffic Engineer.

Chapter Seven:
Customer Relations

Introduction

Ensuring good customer relations is very crucial to the Vehicle Inspection Program and strongly contributes to the success of the model inspection facility. The nice manner and good treatment a customer receives at a test facility promotes the public's acceptance of and support for the program. Station employees must give customers a good impression through proper treatment and a professional appearance. A civilized appearance promotes customers' confidence in the station and reduces their complaints.

A good impression is especially important given that this model station is the first of its kind in Egypt and Africa. It is a new experience for the model station's customers, which means that the role of the staff is essential to convince customers of the importance of VET and engine tune-ups.

Who is Your Customer?

- Motorists
- Officials of the Government of Egypt, and the Governorates
- Public Figures and Media reporters

Dealing with Customers

This is a novel and pilot experience for all customers of the model station. Thus, the inspector in a way plays the role of "teacher": he has to explain, convince, and absorb anger or distress.

Below are some important guidelines to make a good impression on customers:

- **Perfect your Work**. The inspector should always show his readiness to provide the customer with the service required. When customers feel they

are receiving full attention and every consideration, they first trust the inspector and then extend their trust to the service of the inspection facility.

- **Use customer relations' words**, like "please," "thank you," and "you're welcome." Apologize for any errors or delays that occur, and always keep the customer informed about what is going on.
- **Care and promptness**. The inspector must give the customer full attention and be prompt in providing the service as soon as the customer enters the station. If the station is not full, the inspector should be ready to receive new customers.
- **Smile!** This reflects how much you value your work, and indicates your enthusiasm. This in turn is passed onto the customer.
- **Accuracy**. The inspector should be accurate in his choice of words with customers. If a customer's vehicle fails the test, the inspector should say, "the vehicle failed" not "you failed."

Motorists are our valued customers. They cannot all be required to behave in the same manner. Some customers may complain from waiting long or feel anxious or bored, while some may feel they are receiving poor service or are not getting sufficient information. If such problems occur, the inspector must talk to the customer to find out what is wrong and help him. The inspector should explain to the customer what exactly is going on, and if the customer needs more information the inspector should refer him to the station manager. This behavior promotes the customer's trust in the facility and encourages the public to accept the VET program.

If the inspector doesn't know the answer to a question, he is advised to not attempt to guess any answer, and refer the question to the station manager instead. The inspector should not make any comments or give any information about the following topics, even if a customer asks him:

- Repair facilities
- Repair methodology
- Repair needed
- Repair estimated costs

As a vehicle inspector, your responsibility is to provide a proper test of the vehicle and give the results to the customer. You are prohibited from offering any advice concerning the repairs.

Customer Information

In addition to information given to customers by the inspector during the inspection process, printed information in the form of brochures, etc., is available for distribution to customers by the publication officer. They cover the following:

- General information on vehicle inspection and proposed facilities for tune-ups
- Guidance for motorists if the vehicle fails in the test
- Comment cards for customers to express their comments

Customer place their comment cards in boxes provided in each station. The station manager collects these cards and screens them on a weekly basis. He uses the customers' feedback to evaluate and develop the program.

The station manager should assign a publications' representative to ensure the availability and organization of publications in the waiting areas.

Customer Inquiries

Inspectors should answer customers' questions from the technical point of view, giving no personal opinions or comments.

The station manager should answer any question in a friendly, accurate, and polite manner. Answers should be carefully made and within the station policy.

Station Visitors and Tour Requests

There are three categories of visitors:

1. Official visitors who want a detailed tour and explanation of the facility
2. Unofficial walk-ins curious about the vehicle inspection program
3. Media reporters

Visits could be organized to the facility in coordination with the station manager.

In case pressmen visit the inspection facility, they must be respectfully treated. The inspector should answer their technical questions only and refer any other questions to the station manager, who in turn contacts the Public Awareness Department at CAIP, as it is the authorized entity to answer press questions.

It is not allowed for any employee in the station to answer questions made by the press other than those within the domain of the employee's technical work.

Photographs and Interviews

Photographing is permitted outside the facility and for incoming and outgoing vehicles as long as vehicle movement is not affected. Don't hesitate to ask the photographers to move on if their work is impeding the traffic.

If a photographer wishes to take photos inside the facility, the employee should inform him to contact the Public Awareness Manager in CAIP. This protects the security and privacy of the facility and ensures the testing progression. A public awareness employee should accompany photographers who want to take photos of the testing operation.

The station manager's approval is a must to permit taking photographs.

Complaints

Below are examples of customer complaints and how to deal with them.

Procedural complaints are those that include the quality of emission-testing service, improper test procedure, or loss of personal belongings.

Customers complain in two ways. A customer can fill in a comment card as mentioned earlier. Or the customer can complain directly to the station manager. The latter is for complaints requiring immediate action.

If a customer complains of an employee:

- Treat angry motorists with tact and diplomacy
- Do not engage in discussions with customers
- Make every attempt to resolve customer's concerns or claims at the inspection station
- If a concern or claim cannot be resolved at the station level, the matter should be referred to the Station Manager

The Public Awareness (PA) Component of the Cairo Air Improvement Project (CAIP) handles all procedural complaints from customer letters, comment cards, and those referred by the Traffic Departments or EEAA, and reports to the concerned entities to avoid future problems. Complaints are tracked for appropriate resolution.

The task of PA is to answer the technical questions concerning the equipment including:

- Reducing the pollution resulting from emissions and the improvement achieved by the program

- Other CAIP components

Selectivity of Test

Inspectors are required to inspect all vehicles presented for testing at the station. Inspectors have no authority to make decisions about which vehicles should be tested and which should not.

Inspectors who are directly asked by a customer whether they need a test or not should reply, "We do not have the authority to make such a decision. We are required to test any vehicle presented."

Accidents inside the Model Station

1. Accidents not involving station damages

Vehicle accidents that occur on the station grounds and result in no damage for the facility must be immediately reported to the station manager. In addition, the actions below must be considered.

- Move individuals to the emergency waiting areas.
- If necessary, notify the police department.
- If personal injury is involved, render appropriate first aid and/or call for emergency assistance.

The inspection program and/or contractor assume no responsibility or liability of any kind.

2. Accidents involving damage

Accidents involving damage to any part of the building and/or equipment should be immediately reported to the station manager. The following should be done:

- If a customer causes damages, inform the station manager and prepare a status report for the attention of the station and the administrative managers.
- Prepare a detailed Accident Report including the names and addresses of both parties including witnesses, etc. Send the original copy of the report to the program manager.
- Assume no responsibility of any kind. You do not need to make any commitments.

Sample Dialogues between a Customer and an Inspector

Dialogue One: The vehicle passes the test

Inspector: Good morning.

Customer: Good morning. How will you perform this test?

Inspector: I will connect the analyzer to the tailpipe to test the percentage of carbon monoxide and hydrocarbons.

Customer: I'm in a hurry. I have a lot of things waiting to be done.

Inspector: Don't worry, this will only take a few minutes.

Customer: I don't see the importance of this test. All vehicles in the streets are polluting the air in addition to the factories and it is my luck to be the one to pay the price (shaking his head in disapproval).

Inspector: It is important that all of us cooperate to reduce air pollution. We can't ignore these emissions any more as they cause health problems like cancer and lung diseases. The test is required by Environmental Law No. 4/1994, which prohibits the licensing of vehicles not conforming to standards.

Customer: Vehicles belonging to the government pollute the air.

Inspector: The Governor of Qalioubiya stated that he would order all his governorate's vehicles to be tested and tuned to comply with the law.

Customer: It seems reasonable. Where can I get more information about this subject?

Inspector: (presents a program brochure) If you need more information you can contact the Public Service Department at EEAA.

Inspector: Thank you, sir. The test is over and your vehicle passed.

Customer: Thank you for the test and the useful information.

Inspector: Not at all sir, with pleasure.

Dialogue Two: The vehicle fails the test

Inspector: The vehicle failed in the test, sir.

Customer: (angrily) Impossible? There must be something wrong. I've just taken it to the mechanic's yesterday.

Inspector: Allow me to explain. This analyzer measures two components: hydrocarbons and carbon monoxide, as required by Environmental Law No. 4/1994. Your vehicle is a 1993 model, so the HC must be less than 1000 ppm, as the law states The result of your vehicle's test

shows 1200 ppm.

Customer: So? What does that mean?

Inspector: That means that you should take the vehicle to the mechanic's to get the engine tuned up.

Customer: Is there any nearby mechanic who can tune it up?

Inspector: You better find a good mechanic that you are comfortable with. The station Manager has a list of some proposed repair shops.

General Guidelines to Customer Relations

- The customer is entitled to receive the best service even if you don't have other competitors.
- Treat your customer as if (s)he is your houseguest and make him/her feel at ease.
- If a problem occurs, try to see it from the customer's point of view. You will be surprised to find that the customer is right most of the time.
- Make the customer feel as if (s)he is your only customer.
- If you do something wrong, correct the matter in such a way as to satisfy the customer.
- In an unclear situation the solution must be in the favor of the customer.
- Don't attempt to make the customer feel that he is wrong: this is a lost battle.
- After each incident with a customer, ask yourself the following questions:
  - How did I handle the customer request?
  - Was my action effective?
  - Was the customer satisfied?

  If the answer to any of these questions is "no", think of what you could do differently to get it right, and resolve to do that the following time.
- Treat all customers in the same way regardless of their social status, appearance, or nationality.

Manager's Role in Ensuring Good Service

- Each one of us renders a service to others on a daily basis. We serve our families, friends, and even strangers. Good service is thus in our nature as

human beings. But at work our goals change and we seem to need guidance on how to serve others.

- A very important role of the manager is to teach his employees how to render a high quality service. The manager is the trainer, the example, the encouraging, and the psychiatrist. He assumes all these roles while dealing with employees and customers.
- The customer always knows what satisfies him. It is your responsibility to find out what you need to do to satisfy him. As a manager, you must not accept less than the best service for your customers from your employees. All employees are responsible to serve customers. Whether there is a direct contact with the customers or not, all staff affect customer service. It is essential that all employees understand this relation. High quality service cannot be achieved unless every employee feels that he is responsible to satisfy every customer.
- Employees must know how to explain procedures to customers in a simple, easy-to-follow manner.
- Treat the customers as you like your employees to treat them. You may want to treat them better to set an ultimate example for your employees.
- Don't say any negative comments about customers in front of your employees even if you feel the customers deserve it. This may encourage employees to treat customers improperly.
- The customer evaluates employees through the following criteria:
  - Politeness
  - Knowledge of the service and product
  - Ability to take decisions
  - Constant availability

  Do you evaluate your employees according to these criteria?