

9.2 Execution Plan

9.2.1 Outline of Control Measures

(1) Basic Policy

It is necessary for achievement of the pollutant reduction target as above described to revise and reinforce the emission standard. Namely, it is essential for stationary sources to widen the target facilities and to set more strict values, and for motor vehicles to establish the emission standards newly.

The control measures will be proposed for two cases. Namely, measures which must be executed with no restriction on region, and, measures which must be executed within restricted area. The former can be further divided into two for short-term execution and medium- to long-term execution. The time limit aimed at by the measures will be the year 1995 for the short term and the year 2001 for the medium to long term. The long-term measures will be executed in continuation of the medium-term measures.

Among the measures, those related to the administrative organization and institution must be started as soon as possible, and improved and expanded as much as possible for a period of medium to long term, thereby ensuring execution of other technical control measures.

(2) Control Measures for the Whole Area

1) Revision and reinforcement of emission standard

The emission standard must be revised and reinforced and in particular, the new standard must be introduced for motor vehicles. For stationary sources the scope of control need be expanded, with the standard value more strict.

2) Fostering of the Stationary Source Control Engineers

In order to operate stationary sources such as boilers and furnaces efficiently and to reduce pollutant emission, it is necessary to foster such experts as combustion controller, facility maintenance engineer, and pollutant measuring engineer.

On this basis, a system to allow enterprisers to comply with the emission standard should be set up.

3) Enforcement of monitoring of stationary sources

A qualification system need be introduced for persons engaging in operation and inspection of stationary sources, and the operation monitoring system by the administration agency reinforced.

4) Revision of motor vehicle inspection and registration system

Necessary examination items from the standpoint of emission gas control need be included in vehicle inspection system. And at the same time, the current vehicle registration system need be revised so that periodical inspection and coming up to the given standards may be a prerequisite for vehicle re-registration.

To enable this system, it is necessary to formulate the capability of car repair shops to respond the legal periodical check and also necessary to introduce indispensable apparatus such as exhaust gas measuring equipment during idling.

5) Establishment of type approval system of motor vehicles about exhaust gas

A new approval system of new model vehicle should be established, which requires every new model vehicle to satisfy the emission standard at specified driving mode for its type registration. To execute unitarily the examination for this system, a official inspection agency should be founded with chassis dynamometers.

6) Instruction of motor vehicle drivers

In line with the driver's license renewal system, periodical instruction to master the driving and vehicle operation method contributing to reduction of pollutant need be executed.

7) Suppression of operation of diesel vehicles

Operation of diesel vehicles in the city center will be suppressed.

8) Review of the Tax Assessment System on Vehicles

It is necessary to review the assessment system of vehicle tax in order to reflect the grade of contribution to the activities for air pollution control, and through this revision, the vehicle change to new model or one with emission control should be accelerated.

9) Hydrocarbon evaporation control

In order to suppress emission through evaporation of hydrocarbons used as fuels and solvents, the scope and method of regulation need be studied for its implementation in future.

10) Subsidy to private investment in pollution control measures

A public subsidy system need be established for the owners of stationary sources and motor vehicles who invest in pollution control, thereby promoting implementation of control measures. As subsidy, deduction of related tax, long-term low interest loan, subsidy, etc. may be chosen depending on the purpose.

11) Review of land use

The city plan need be reviewed to construct low-polluted city. For example, policies such as a structure of multiple centers, introduction and improvement of mass transit, transfer of factories, and expansion of green zone are to be reflected in the plan.

(3) Control Measures for the Whole Area (Short-term)

1) Improvement of combustion

The combustion control instruments need be introduced into the combustion facilities (in particular, large facilities) to achieve efficient combustion, thereby reducing the dust emission and fuel consumption.

2) Fuel reforming or conversion

Light oil is to be mixed into the fuel for the large crude oil combustion boilers to reduce the sulfur content and thus the SO_x emission quantity. Compounds containing oxygen such as MTBE (methyl tributyl ether) or ETBE (ethyl tributyl ether) are to be added to gasoline to reduce the CO and HC emission amount.

3) Introduction of dust collector

Dust collectors (cyclone, scrubber, etc.) are to be introduced into large stationary sources which exceed the dust emission standard substantially to reduce dust emission quantity.

4) Reduction of heat loss

Heat insulation performance of the combustion facilities need be improved to reduce the heat loss and to save the fuel and its cost as well as to reduce the pollutant emission quantity. This will enable recovery of the equipment investment within a short period through reduction of the fuel cost.

5) Reform of the used gasoline motor vehicles

CO and HC emission quantity need be reduced through taking secondary air into intake and exhaust manifolds and through introduction of catalyst unit. The fuel evaporation gas trap is also be installed to reduce the HC emission.

6) Prevention of scattering of soil dust

Scattering of soil dust in soil mining sites and from treatment and transportation of material soil need be prevented. For this purpose, water spray, dust collecting hood, building, fence, temporary pavement of the work passage, and forestation of the soil mining ruins.

(4) Control Measures for the Whole Area (Medium- to Long-term)

1) Improvement of combustion

The low NO_x burner need be introduced for about the ten largest oil combustion boilers to reduce the NO_x emission quantity.

2) Fuel reforming or conversion

In addition to the short-term improvement measures, reduction of SO_x emission quantity is attempted through reduction of the sulfur content in gasoline, adjustment of coal grain size, and fuel conversion of the batch type kilns for bricks and clay pipes to natural gas.

3) Introduction of high-efficiency dust collector

Dust collectors with efficiency higher than those for short-term measures is to be introduced principally into large stationary sources, thereby reducing the dust emission quantity.

4) Reconstruction the trolley bus network

The semi-governmental trolley bus enterprise will be newly founded to restart transport, with the route network improved and expanded. It is expected that eight planned routes will account for 5% of total bus traffic within the city. The corresponding reduction of bus traffic may lead to 5% reduction of pollutant emission from buses.

5) Construction of passenger railway

The government-owned enterprise will put the passenger railway of a total of about 23 km length into service in the first phase (- 1995). In the final stage, the railway network of a total of 44 km will account for about 15% of the total bus traffic within the city. This railway is planned to make up a framework of passenger transport by arranging stations linked with the trolley bus network.

Since passengers will move from buses, the corresponding reduction of bus traffic is expected to reduce the pollutant emission by 15% of the total emission from buses.

6) Improvement of the public bus system

Since the buses, which are inexpensive and convenient to use, will remain the major means of person transport in future, their contribution to air pollution can be reduced by improvements as described below:

- Installation of the exclusive bus lane, construction of exclusive bus stops, promotion of the two-level crossing, and improvement of the plane shape of intersections will be made for the arterial bus routes to ensure smooth operation of the bus service.
- The fare collecting method is to be improved to shorten the stop period for passengers to get on/off the buses, thereby contributing to ensure smooth traffic flow.

- Larger size buses are to be introduced to reduce the total number of buses.

(5) Control Measures for the Specific Area

1) Area around large intersections

Generally, the area along the arterial roads tends to suffer localized high-level pollution because of highly densed motor vehicle traffic. This trend is particularly obvious around large intersections. Accordingly, it is recommended to provide vacant space as a buffer area and to restrict the residential location around the intersection, thereby alleviating pollutant dispersion prevention by large buildings and preventing the health damage.

2) Specific stationary sources

A local air pollution caused by stationary sources may be attributed more to the small distance between the sources and surrounding housing areas than to the scale of the sources. Smoke discharged nearby enters the neighboring area, without sufficient dispersion, causing readily high-level pollution. Countermeasures are taken for large smoke sources in any place. For small smoke sources, an effective method to reduce the concentration reaching the ground is simply raising chimney height.

9.2.2 Cost of Control Measures

The costs required for proposed measures are shown in Table 9.2.1, excluding the cost of traffic measures for which the construction investment plan has already been established.

Table 9.2.1 Estimated Total Cost for Control Measures

(Unit: million pesos)

	Short-term Measures		Medium to Long-term Measures
	Private Investment	Public Investment	Private Investment
Control measures against stationary sources	2,490	1	2,210
Control measures against mobile sources	120	2,890	76,000
Total	2,610	2,891	78,210

The private investment of 1987 in Santafe de Bogota City was about 37 billion pesos in total. On the other hand, the private investment for short-term measures is about 650 million pesos in average for four years from 1992 to 1995, which is 1.8% of the whole investment in plant and equipment. The total sum of private investment for medium to long-term measures is about twice as large as the total sum of investment in plant and equipment.

The gross revenue of Santafe de Bogota City as of 1988 was 77.7 billion pesos. The public investment is about 700 million pesos in average for four years, which is equivalent to 0.9% of the whole revenue of the city.

In addition, the municipal authority is to spend annually 50 million thousand pesos for the maintenance of the monitoring system in the general budget.

9.2.3 Promotion of Plans

(1) Organization

The Ministry of Health and Welfare, and Santafe de Bogota City will be the agencies in charge of planning and coordination for air pollution control, to which various levels of governmental agencies controlling the pertinent field, the Health and Welfare Bureau of Santafe de Bogotá, D.C., and neighboring autonomous authority organizations will provide cooperation.

The related administrative agencies will put the control plan into practice while attempting coordination with existing social and economic plans, urban plans, and traffic plans. At the same time, these agencies will establish a liaison conference to control the progress of the plan.

On executing the plans, the authorities will call upon positive participation and cooperation of citizens and enterprisers while paying due attention to preservation of healthy environment and stabilization of the life of citizens.

Individual citizens must recognize that they are not only victims, but also can cause pollution through production and utilization of motor vehicles. They have to cooperate actively in policies presented by the administrative agencies.

Enterprisers contribute greatly to the social and economic activities through production and transport activities. On the other hand, however, they have to recognize their social position that they are inflicting considerable effects on the citizen life. It is essential for them to cooperate positively and do their best for realization of the planned target and policies.

(2) Monitoring System

1) Monitoring of air quality

Air quality monitoring must be made to judge if the air quality satisfies the environmental standard and if the control measures are successful.

It is also desirable to continue measurement of dust at 13 stations that had been operated by the Santafe de Bogota authority, not to mention the automatic monitoring newly established in this study.

It is also necessary to conduct non-periodic monitoring by simplified method at points where high concentration is expected to appear.

2) Monitoring of pollutant sources

As regards factories, the enterprisers are demanded to execute self-monitoring and self-improvement in order to enforce the emission regulation all-out.

At the same time, the witness inspection system by the municipal authority must be enforced. Survey to obtain data on fuel consumption, actual state of air pollutant emission, and stack condition must be continued.

For motor vehicles, it is necessary to improve and expand statistical information including the number of motor vehicles by engine type and displacement and yearly number of registration, apart from yearly survey on the regional traffic volume and traffic by vehicle type.

In putting the motor vehicle emission gas regulation into practice, it is necessary to know the effect of the regulation by establishing a system (chassis dynamometer and exhaust gas analyzer) to measure the pollutant emission quantity at the actual driving modes.

3) Utilization of environmental information

In order to analyze the monitoring result promptly and to ensure systematic counteraction for the result, environmental information centering on air quality and meteorological data, and pollutant source data must be compiled into a data base system, which should be developed to a general environmental information management system.

9.3 Summary

As a conclusion of this study, the proposed countermeasures are systematically shown in Fig. 9.3.1.

Among these measures, the measures selected from the viewpoint of fundamental improvement of the pollution structure in Santafe de Bogota City are as follows.

Priority measures against motor vehicles

- Establishment of motor vehicle emission standard
- Revision of motor vehicle inspection and registration system
- Establishment of type approval system about emission gas
- Review of motor vehicle tax system
- Reduction of CO and HC from gasoline vehicles in use based on the vehicle emission regulation and the vehicle inspection system
- Supply of low-sulfur gasoline
- Reduction of traffic volume through introduction and improvement of mass traffic means such as passenger railway

Priority measures against factories

- Reinforcement of emission standard
- Improvement of combustion control and fuel conversion
- Fuel saving by using heat insulating material
- Installation of dust collectors into large facilities violating the dust emission standard
- Prevention of soil dust scattering in soil mining sites, soil yards, etc.

Other priority measures

- Subsidy system for investment in pollution control measures

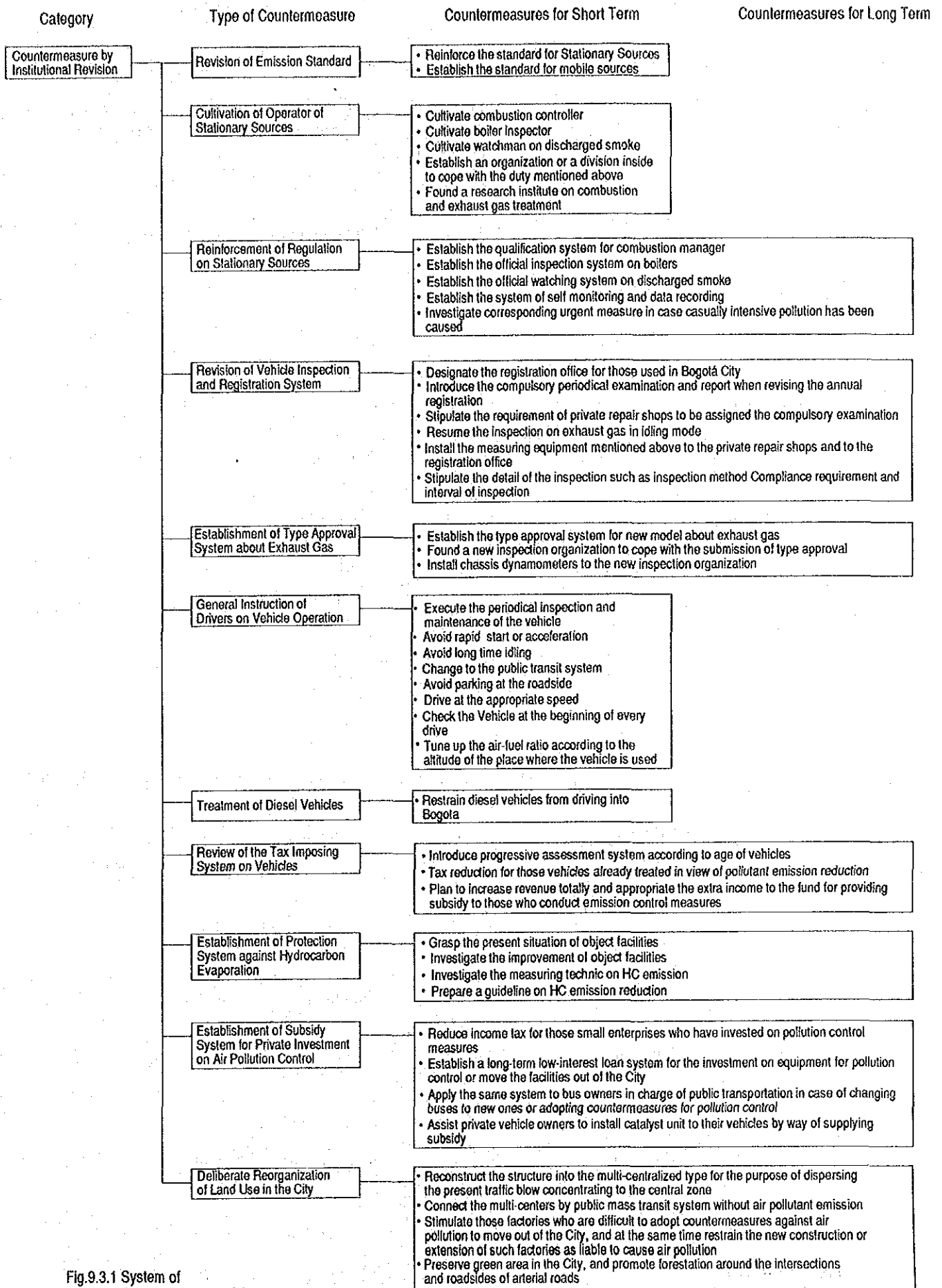


Fig.9.3.1 System of Countermeasures (1)

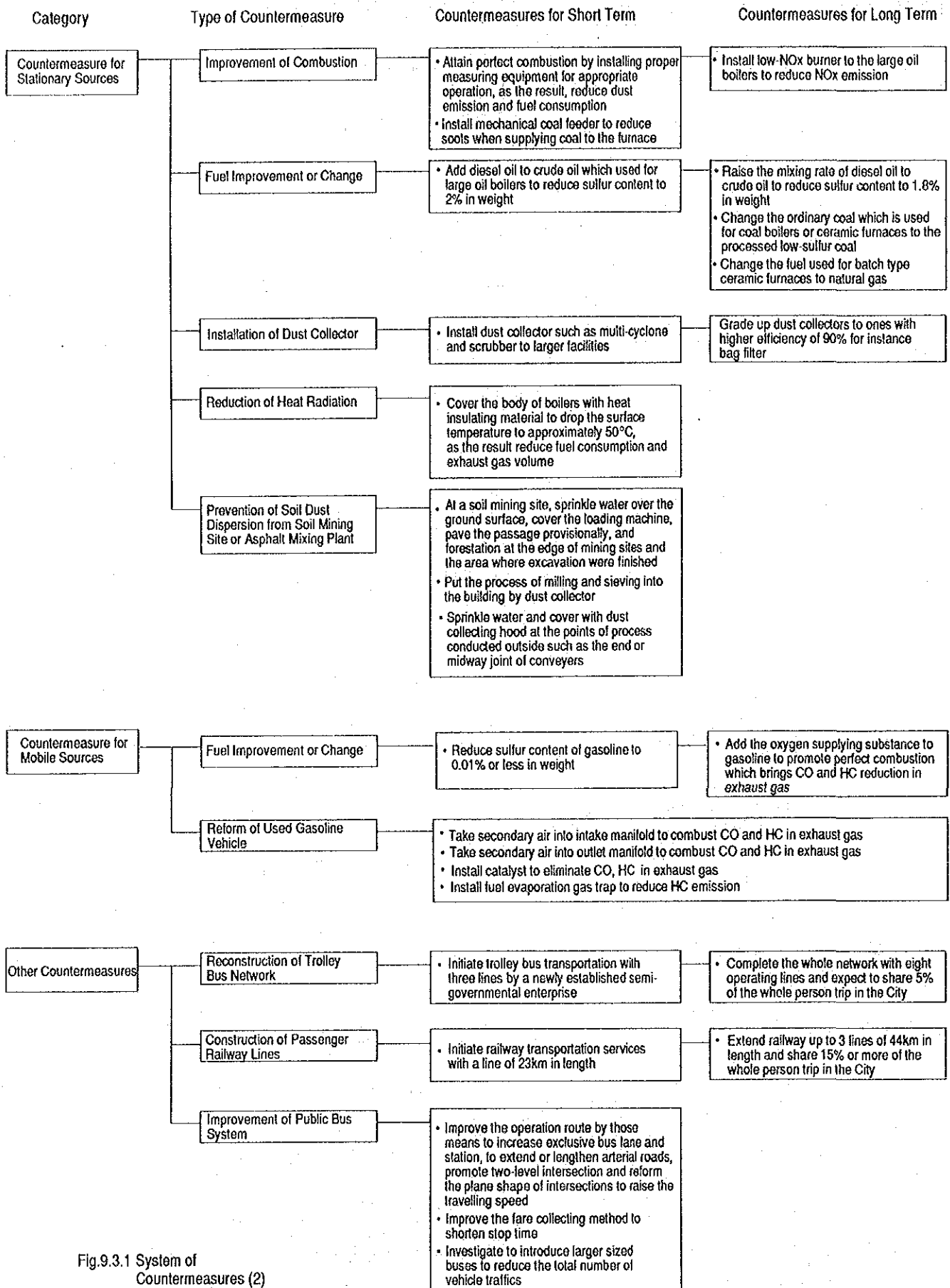


Fig.9.3.1 System of Countermeasures (2)

