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Malaysia
Managing Costs of Urban Pollution
Country Economic Report

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Country Department I
East Asia and Pacific Region

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CURRENCY EQUIVALENTS

		Currency unit	=	Ringgit
Average 1993	-	US$1.0	=	M$2.5798
(first 3 quarters)		M$1.0	=	US$0.3876
Average 1992	-	US$1.0	=	M$2.5474
		M$1.0	=	US$0.3926
Average 1991	-	US$1.0	=	M$2.7501
		M$1.0	=	US$0.3636
Average 1990	-	US$1.0	=	M$2.7049
		M$1.0	=	US$0.3697
Average 1989	-	US$1.0	=	M$2.7088
		M$1.0	=	US$0.3692
Average 1988	-	US$1.0	=	M$2.6188
		M$1.0	=	US$0.3819
Average 1987	-	US$1.0	=	M$2.5196
		M$1.0	=	US$0.3969
Average 1986	-	US$1.0	=	M$2.5814
		M$1.0	=	US$0.3874

GLOSSARY OF ABBREVIATIONS

ABC	Action Plan for a Beautiful and Clean Malaysia
ASEAN	Association of South-East Asian Nations
BAU	Business As Usual
BOD	Biological Oxygen Demand
CNG	Compressed Natural Gas
CO	Carbon Oxide
CPA	Central Planning Area
CVLB	Commercial Vehicle Licensing Board
DOE	Department of Environment
EE	Energy Efficiency
EIA	Environmental Impact Assessment
EQA	Environmental Quality Act
EQR	Environmental Quality Report
FMM	Federation of Malaysia Manufacturers
GDP	Gross Domestic Product
GNP	Gross National Product
GOM	Government of Malaysia
HC	Hydro Carbon
HSU	Hartridge Smoke Units
IMR	Institute of Medical Research
INEP	Integrated National Energy Planning
IPPS	Industrial Pollution Projection System
IWD	Industrial Work Department
JICA	Japan Internatinal Cooperation Agency

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MANAGING COSTS OF URBAN POLLUTION IN MALAYSIA

Country Economic Report

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This report has been prepared by a team consisting of Ijaz Nabi (task manager), Finn Nielsen (urban services), Nobuko Ichikawa (hazardous waste), and consultants Jean Tilly (health), Anjum Altaf (willigness-to-pay), Anke Meyer (transport), Mujahid Iqbal (industry) and Judy Lu (Research Analyst). Jane Tameno gave excellent secretarial service. The report is based on a mission to Malaysia in November - December, 1992.

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MANAGING COSTS OF URBAN POLLUTION IN MALAYSIA

Executive Summary

1. Malaysia has enjoyed one of the least polluted urban environments in Asia. Lately, however, sustained rapid economic growth has started to impose costs in terms of industrial pollution and degradation of the urban quality of life. Traffic congestion, noxious fumes and leaky toxic waste sites are now as much part of newspaper headlines in Malaysia as in other rapidly developing countries. The goal of achieving industrial country status by the year 2020, and the associated industrial and urban expansion, will further strain the urban environment.

2. Perhaps the most potent force for policy change and corrective measures is social awareness of environmental degradation and this has started to grow: media coverage, a new legitimacy for the environmental NGO's, a flourishing market for pollution abatement consultants and the busy agenda of the Department of the Environment indicate that the environment is now an important aspect of the quality of life. Increasingly, policy makers are responding to this heightened social awareness and are seeking to identify priorities and design appropriate policies to protect the urban areas. However, this requires a careful balance between growth objectives and environmental concerns. Thus a policy has to weigh the benefits of environmental protection, which are often difficult to quantify, against the possible loss of international competitiveness associated with the cost of pollution abatement. Moreover, policy makers must choose the most cost-effective measure available to achieve the desired level of pollution abatement.

3. The environment has not been neglected by the government in the past. An array of legislation is in place that sets emissions standards and the government spends RM 150 million annually to monitor violation of standards and enforce regulations. Moreover, the Sixth Plan (1990-95) has made a firm commitment to safeguarding the environment. However, given rapid industrial and urban growth, much more needs to be done both in terms of allocating greater financial resources for pollution control as well as developing more cost-effective interventions.

4. The policy agenda for protecting Malaysia's urban environment would consist of: (a) identifying the principal form of urban pollution and the sources responsible for it; (b) estimating the benefits from reduced pollution in terms of decreased health costs and other amenity improvements; (c) reviewing the current pollution abatement policies for industry and transport to suggest cost-effective alternative strategies; and (d) evaluating urban services such as clean drinking water, and sewerage and solid waste collection and disposal to suggest improvements in the delivery systems. The recommendations made in this report

complement the institutional reform outlined in a report delivered to the Government in fiscal 1992[1].

The Principal Forms of Pollution and Their Sources

5. The kinds of pollution examined are: (i) air pollution; (ii) water pollution and (iii) hazardous waste accumulation. (Existing government regulation for controlling these forms of pollution and cost-effective policy options are discussed in subsequent sections in the context of economic activities that cause pollution.)

Air pollution

6. Suspended particulates and lead are the principal forms of air pollutants in Malaysia. Importantly, sulphur dioxide emissions from vehicles are also on the rise[2]. Lead emissions into the air have declined in recent years (after the introduction of unleaded gasoline), but levels are still quite high in selected localities and continue to pose a serious hazard to young children.

7. Kuala Lumpur is now one of 15 Asian cities that have the greatest levels of pollution from suspended particulate matter (TSP): the average reported concentration levels at 53 percent of monitoring stations far exceed WHO standards. The most frequent violations in Malaysia are in areas of heavy traffic and industrial concentration in Petaling Jaya, Pasir Gudang, Kuala Lumpur and Shah Alam. These are also the centers with high concentrations of PM10 that are particularly harmful to human health. TSP concentration levels reached dangerous proportions during the haze in 1991 when recorded levels were nearly five times the WHO standard and visibility was reduced to one kilometer in many areas.

8. Both industry and transport pollute the environment, but the latter is largely responsible for air pollution in Malaysia; it contributed 75 percent of total emissions into the air in 1991, an increase of 12 percent over 1987. Lead pollution is entirely due to transport. Among the industrial sources of non-lead air pollution, the worst polluters are wood-based, palm oil, food processing non-metals, textiles, rubber products and iron and steel industries.

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[1] "Integrating Environmental Management And Development Planning In Malaysia", East Asia Country Department I, The World Bank, Washington D.C, July 1992.

[2] Power generation is Malaysia largely oil and natural gas based so that sulphur dioxide emissions from this source are not a serious problem.

Water pollution

9. Water pollution in Malaysia is measured in terms of biological oxygen demand (BOD), suspended solids and the presence of heavy metal in rivers. On BOD criterion, Malaysian rivers are heavily polluted with mean levels nearly six times the international standard. Judging by Malaysia's own Water Quality Index, the majority of rivers are moderately to highly polluted and the trend is on the increase. Fecal coliform are measured sporadically. Some samples indicate that this may be a serious problem; thus levels need to be monitored regularly.

10. Residential sewage accounts for nearly 80 percent of BOD-related water pollution, followed by agriculture (13 percent) and industry (8 percent). The most important source of water pollution are food-processing, rubber products, chemicals, palm oil and the textile sectors.

Solid waste

11. Income growth and urbanization have changed consumption pattern, which has placed a heavy load on urban solid waste facilities. In 1989, solid waste generated in Kuala Lumpur was 1.29 kgs per person per day, more than twice the level in Manila (0.50 kgs) and substantially higher than in Jakarta (0.75 kgs) and Bangkok (0.88 kgs). Increasingly, the cities use unsafe solid waste landfills and frequently resort to open burning, which cause both air and water pollution.

Hazardous waste

12. Although estimates are somewhat dated, there is little doubt that hazardous waste, a by-product of industrialization, is now accumulating very rapidly. Acids (22 percent) and heavy metal and mineral sludges (27.6 percent) are the most important types. Nearly half the waste is generated by the metal finishing, electronics and textile industries concentrated in Penang, Selangor, Johor Bahru and Kuala Lumpur. In fact, some experts project that the share of industry producing this waste in total industrial waste will rise relative to water and air polluting industry until per capita income reaches US$ 4400, after which the share will fall. Exposure to hazardous waste can have severe local consequences as with mercury poisoning in Japan and the recently reported rise in leukemia cases and infant deaths in Ipoh.

The Health Benefits of Pollution Abatement

13. Malaysia enjoyed considerable improvements in health in the past 20 years; infant mortality rates declined and life expectancy increased. But, prosperity, industrialization and a faster, more demanding pace of life bring to the fore such new diseases as hypertension and coronary heart problems - diseases that worsen when the urban environment degrades due to pollution. In addition, urban pollution leads to new forms of illness; for example, high concentrations

of particulate matter and sulphur dioxide in the air exacerbate respiratory dysfunctions. Lead in the atmosphere is particularly harmful to children. Polluted water systems attack the digestive tract and exposure to hazardous waste increases the risk of cancer.

14. These diseases impose substantial health costs both in terms of productivity loss due to morbidity and mortality as well as direct treatment costs. During the haze of 1991, public hospitals reported a 10 to 15 percent increase in the number of admissions related to respiratory illness. Private doctors and clinics reported even larger incidence of illness, particularly asthma attacks. This report shows that reducing ambient concentrations of particulate to the recommended Malaysian guideline in Penang, Perak, Kuala Lumpur, and Johor would prevent pollution related sickness and death and the associated loss of productive working days. Similarly, reducing ambient concentrations of lead by 90 percent in Kuala Lumpur and Selangor would reduce the incidence of hypertension and would curb the harmful effects on children's intelligence development. Illustrative estimates show that the total costs avoided by reducing ambient concentrations of particulates and lead amount to RM 3.1 billion, which is substantial considering that Malaysia's total health expenditure in 1992 was RM 2.1 billion.

15. Water borne diseases are still prevalent and constitute a public health problem. Unfortunately the data base for calculating disease incidence is quite weak. As a rough estimate, taking into account reported cases at public and private clinics, there may be between 25,000 - 50,000 cases of water borne illnesses in Malaysia. Domestic sewage is responsible for the large incidence of such diseases, especially in cities with inadequate sewerage system. For example, in the early 1980s, there were two outbreaks of gastro-enteritis in Seramban where, during the dry spells, tap water is often heavily contaminated with domestic sewage that seeps into the drinking water system due to inadequate treatment and poor drainage.

16. Water and sanitation projects are highly effective in combatting water-borne diseases. A review of 144 cross-country studies indicates that improvements in water supply and sanitation in general reduce diarrhoeal diseases by 22 percent. Adjusting this for Malaysia, up to RM 75 million could be avoided in treatment expenses and work loss by improving water delivery systems.

17. The entire environment is affected by improper disposal of hazardous waste. Ingestion of contaminated surface water and inhalation of contaminated air affect affects human health immediately, while the carcinogen chemicals in hazardous wastes can cause disease after long periods of latency. Excessive exposure impairs heart, lung, kidney, and liver functions and is associated with thyroid and neurological disorders. Stringent regulations for proper hazardous waste management, as in the U.S., could prevent a fair number of such disorders.

18. The <u>health effects of environmental degradation</u> need to be measured systematically to evaluate benefits and thus improve the design of policy. The recommended steps are:

- <u>Additional air and water monitoring</u>. Pollutants such as ozone, carbon monoxide, nitrogen oxides, and sulfur dioxides should be analyzed and

reported as often as particulates and lead. Also, a systematic monitoring of particulate matter smaller than 10 microns should be done since this is a better indicator of health risk than TSP alone. Finally, all major rivers should be monitored annually for the presence of E.Coli.

- Collecting health statistics from private doctors and clinics. Health statistics compiled by MOH cover only public hospitals. Coverage should be extended to include private hospitals and clinics as well. This will allow a comprehensive reporting of the incidence of asthma attacks and bronchitis, and will provide a better understanding of the link between environmental pollution and health. Surveys, such as the 1987 Morbidity Survey, should be carried out annually; these should include questions on poverty indicators and on access to public facilities.

- Developing Malaysian-specific dose-response functions. Dose-response functions measure the relationship between exposure to pollutants and sickness: Malaysia-specific dose-response functions would be very useful for carrying out cost-benefit analyses of pollution control policies. Information gathered in incidents such as the recent haze could be used to develop such dose-responses.

- Creating a Toxic Release Inventory. Such inventories would provide annually updated information on the toxic chemicals released by Malaysian factories. The inventories should quantify releases into environmental media (e.g., air, water, soil) as well as transfers of wastes to other factories or other countries.

- Creating an Environmental Health unit. Such a unit would investigate health complaints stemming from environmental problems. Although the unit would not have any enforcement powers, unit officials should be authorized to enter premises suspected of causing health problems and evaluate these on the basis of standards set by the DOE and the local authorities. The findings should be passed on to the Ministry of Health and the DOE for remedial action.

Cost-Effective Strategies for Pollution Abatement

Industrial pollution

19. Malaysia's manufacturing output increased eightfold between 1970-92. In 1992, it stood at RM 43.1 billion and accounted for 29.3 percent of Malaysia's

GDP, 44.1 percent of exports and 20.5 percent of employment. While this has brought skilled urban jobs and higher incomes, it has also contributed to the problem of industrial pollution. The most important forms of industrial pollution are suspended particulate discharges that cause air pollution, BOD (Biological Oxygen Demand) discharges that cause water pollution and toxic waste discharges that affect all elements.

20. The technical options for industrial pollution abatement constitute a rich menu ranging from streamlining the production process (to improve efficiency) to installing new equipment (to reduce end-of-the-pipeline emissions). Some of the options involve technologies already used in developed countries and may not be very expensive. Others may be costly and, given the widespread view that additional costs would harm industry competitiveness, there is no guarantee that industry will voluntarily install abatement equipment. Thus, policy makers need guidance about costs and priority industries in order to design cost-effective regulations.

21. Evidence from developed countries shows the loss of international competitiveness due to pollution abatement is not as serious a concern as often thought since the amortized cost of pollution control measures may not be very high. In the U.S. and Japan, the average annual investment in pollution abatement equipment is around 4 percent of total plant investments. Extrapolating these to Malaysia, the annual cost of pollution abatement investments would be 0.3 to 0.6 percent of GDP. The well-documented successful experience of the palm oil sector also shows that pollution control costs are not high ---- it is estimated that palm oil effluent treatment costs are about 0.7 to 1.4 percent of the total cost of palm oil production.

22. To date, Malaysia has used with some success several direct and indirect instruments for industrial pollution abatement, such as emissions guidelines and standards, environment impact assessments (command and control measures) and effluent permits, fiscal incentives and technical research and advice (indirect measures). Pollution control is mandated by an array of laws. Environmental Impact Assessments are required for 19 activities in order to tackle pollution at an early stage, rather than at the end when retrofitting is expensive. In addition, the Department of the Environment has set a large number of emissions standards for air, water and toxic waste, which do not appear to be excessively stringent, and effluent standards for the rubber and palm industries, although adequate, are not as tough as those in Indonesia. Monitoring is expensive and is done selectively: for example, palm oil and rubber sectors are covered well with 42 and 33 percent (respectively) of the firms checked. These are chiefly the large polluters, that account for the bulk of emissions in these two sectors. However, the rest of the industry is basically self-monitored.

23. Effluent charges are also levied to curb water and air pollution, especially on firms in the palm oil, rubber and food processing sectors. Technical assistance continues to be provided to palm oil and rubber firms to switch to cleaner manufacturing processes. Moreover, several fiscal incentives, such as import duty exemptions and "pioneer status", are available to firms which invest in equipment that prevents pollution and enables safe management of hazardous waste.

24. Accompanied by tight monitoring, the country's pollution abatement policies have worked well to combat pollution in the palm oil sector. However, as industrialization deepens and gathers pace, the costs of carrying out EIAs and monitoring standards will rise. Moreover, the evidence from many countries shows that costs of pollution abatement per unit of output vary considerably, so that direct interventions such as uniform effluent standards are not cost-effective because they do not distinguish between high and low cost pollution abaters. For example, in the Philippines, the average cost of treatment per ton of water effluent ranges from US$0.18 for slaughter houses and US$0.90 for paper and pulp units. Cost-effectiveness considerations would require that polluters that can lower pollution relatively cheaply should do so first and to a greater extent than polluters whose abatement costs are high. Market based interventions, such as an effluent charge, allow for such differentiation and trade-offs among polluters. However, an effluent charge requires considerable monitoring. A more cost-effective measure is a presumptive charge based on plant output. It is a good proxy for an effluent charge and is much easier to monitor and administer. This is further elaborated below.

25. The six elements of a cost-effective industrial pollution abatement strategy involve (i) reviewing the overall industrial incentives structure, (ii) identifying priority sectors, (iii) levying presumptive pollution charges, (iv) using industrial zoning, (v) attending to the problems of small firms and (vi) addressing the special issues in industrial hazardous waste.

26. Overall incentive structure. Overall industrial incentives go a long way towards curbing pollution efficiently. If tax incentives and other subsidies make a polluting industry (artificially) profitable, reforming these would be the first priority when designing an efficient pollution abatement strategy. In fact, while Malaysia's industrial policy regime is less distorted than that of many developing countries, selected pockets of high protection still exist which gives the wrong signal to the polluters. Moreover, many small and medium firms, often the largest sources of pollution, escape the tax net and are thus uncontrolled. Such incentives to pollute need to be removed.

27. Setting priorities based on the industrial structure. Pollution abatement policies are expensive in financial resources and in terms of personnel skills. Priority should thus be given to the most serious polluters. Although a comprehensive emissions inventory is not available, the DOE has identified the wood-based industry to be the target industry for air pollution, food processing the priority for water pollution abatement, and the metal finishing sub-sector in the machinery, engineering and electronics sectors the focal point for hazardous waste efforts. Combined, they account for 36 percent of manufacturing value added and fixed assets and are responsible for the largest shares of pollutants emitted. In order to correctly identify priority polluters, emission inventories must be updated regularly to assess sectoral pollution loads.

28. Industrial structure also helps in choosing between different interventions. For example, 655 firms operate in the wood-based sector and 420 firms process food. The majority, (56.3 percent and 69.8 percent, respectively) are small, so that direct monitoring of these firms would be prohibitively expensive. For this reason, indirect measures would be more cost-effective.

Furthermore, there is a large presence (71 percent of the equity) of foreign investors in the metal finishing sector which is, moreover, dominated by a few large firms. This suggests that the more stringent standards operating in the parent countries (especially those originating in Japan and the OECD countries) could be tailored to Malaysia's conditions and the DOE could monitor small local vendors and encourage them to use cleaner processes by working through the parent firms.

29. Presumptive Pollution Charges. As argued above, cost effective pollution abatement can be achieved with an instrument such as a presumptive pollution charge. The charge would be based on technical norms that relate firms' output to pollution emissions (the norms would be established by maintaining an updated emissions inventory) and would be combined with rebates to provide incentives to switch to cleaner technologies: Firms that use cleaner technologies and reduce emissions could claim a refund. This is similar to what is already done with the value added tax and when import duty rebates are given to exporting firms. Thus, administering such a charge would not be too complicated and could be designed along well-known practices. The updated emissions inventory for levying the presumptive charge would have the added advantage of strengthening the knowledge base on the sources and forms of industrial pollution in the country.

30. Presumptive abatement charges could also be used to correct any perverse incentives that might encourage industries that pollute heavily to migrate to Malaysia. A case in point is the corporate income tax that is designed to attract investors in selected industries. Presumptive abatement charges (based on known emission levels associated with the firm's technology) would be a clear signal to investors that Malaysia is not a pollution haven. Besides, as argued in the Bank's report, "Fiscal Reform for Stable Growth" (April, 1992, 10120 MA), such incentives are a heavy burden on the Treasury and, in any case, incentives are not what attracts investors to Malaysia.

31. Small firms. These account for 60 percent of the total firms in Malaysia and often use dirty technologies. The pollution abatement strategy for such firms would have three elements. First, in sectors where sub-contracting arrangements abound (as in the electronics sub-sector), small vendors could be reached if the large firms were required to keep an inventory of the emissions produced in the processes subcontracted out. Presumptive charges could be levied on large firms and these, combined with rebates, could provide the incentive for the large companies to clean up their vendors in the most cost-effective way. This lowers the monitoring burden on the regulating agency and was used with great effectiveness in Japan.

32. Second, PORIM (Palm Oil Research Institute of Malaysia) and RRIM (the Rubber Research Institute of Malaysia) have demonstrated considerable success in carefully targeting technical assistance to firms for combating pollution in the palm oil and rubber sectors. Such success, moreover, was achieved at low cost: between 1980-83, at the height of its activity, PORIM spent RM1.2 million on R&D, while RRIM spent RM 2 million in the Fifth Malaysia Plan period, 1986-91. The lessons of this experience in refining processes that reduce pollution emissions

should be applied to small firms in the wood-based and food processing sectors.

33. The third area that holds considerable promise is promoting waste minimizing techniques in small firms. Waste minimization curbs pollution by improving the efficiency of input use. MIDA (Malaysian Industrial Development Authority) recently carried out a waste minimization feasibility study for the electroplating and capacitor manufacturing firms and found that between 50-90 percent of the waste could be reduced at a very low cost and within a short pay-back period.

34. Industrial Zoning. Malaysia's experience with industrial zones is good, particularly with export promotion zones. They have worked well because the scale economies in the provision of infrastructure have been successfully exploited. Such economies also exist for the infrastructure to collect, treat and safely dispose of industrial pollutants, especially hazardous waste. Pollution abatement within industrial zones could be made cost-effective by holding local authorities (under whose jurisdiction industrial zones lie), accountable for the total emissions generated. This would lower monitoring costs and would leave it to local authorities to decide the least-cost abatement solutions.

35. However, the zoning option must be used judiciously and most often for medium and large firms. Conversely, small firms should not be herded into these zones because many might not survive the dislocation. Their existence may depend on the use of a spare room in the house or backyards, which reduces overheads. Moreover, although small polluters may generate high pollution per ton of output, they contribute just a fraction to the total waste generated.

36. Special Issues in Industrial Hazardous Waste. As Malaysia develops and incomes rise, the industrial structure will change. Based on the experience of developed countries, the change will be towards more sophisticated industries that generate larger amounts of hazardous and toxic waste per unit of output. These trends suggest that in the immediate future, the abatement of hazardous waste will take on greater urgency.

37. Because not all risks are equal and not all hazardous waste problems can be treated at once, risk assessments are needed to rank the wastes that should be treated first based on the cost effectiveness of risk reduction. The results of assessments indicate that heavy metal sludge, alkaline wastes and acid waste should be treated first. Their treatment has the highest pay-off in terms of risk reduction per ringget of expenditure.

38. Further, much more information than is currently available is needed to assess the relationship between foreign investment and hazardous waste accumulation. The recent case in Ipoh involving improper disposal of hazardous waste by a firm with substantial Japanese investment (which is argued to have caused a rise in cases of leukemia and infant death) suggests however that a trend may exist, particularly in the electronics industry. The sector uses hazardous chemicals intensively and is dominated by Japanese and U.S.

multinationals. The Japanese government is quite keen to ensure that investors abroad adhere to the higher home-country standards of pollution abatement. The Malaysian authorities should take advantage of such opportunities of cooperation in designing cost-effective abatement of hazardous waste.

39. Authorities have recently decided to privatize the collection, treatment and disposal of hazardous waste. (The waste is currently stored by firms on their premises and storage capacity is now exhausted). The contract to build, own and operate the treatment facility is to be given to a consortium led by the Danish firm, I.Krueger. The consortium proposes to invest US$200 million in the facility and no new entrants are to be permitted until the year 2005. However, at least four outstanding issues need attention before finalizing the contract. First, a correct estimate of the quantity of hazardous waste will determine the investment to be made in the facility as well as the price to be charged; moreover, current policy disallowing import of hazardous waste needs to be clarified, especially with the respect to ship sludge -- which is allowed to enter. Second, safety standards regarding transportation and transfer stations are not in the current EIA in any detail; these need to be firmed up, especially with regard to the quality of vehicles and routing. Third, arrangements must be made to ensure that small generators are serviced by the privatized concern. This would involve a subsidy to the private contractor to cover the cost of providing the service to small firms combined with fines for illegal dumping. Last, institutional interaction between the DOE (as the technical watchdog over I. Krueger) and the EPU (as the regulator of the monopoly) needs to be clearly defined.

Road Transport

40. Transport pollution abatement must be a priority on the policy agenda. The DOE estimates that in 1991 mobile sources of pollution accounted for 94 percent of carbon monoxide emissions, 44 percent of hydrocarbons, 40 percent of nitrogen oxide and 6 percent of particulate matter and sulphur dioxide. Emissions have increased with the rapid expansion of the vehicle fleet, which more than doubled to 3.5 million vehicles between 1980 and 1991. In Kuala Lumpur, at 10.5 percent a year, vehicle growth has been even faster.

41. Apart from the hazards of TSP and lead emissions discussed earlier, the expansion of the vehicle fleet has led to congestion, which imposes high time costs. It is conservatively estimated that traffic congestion in Kuala Lumpur adds 15 minutes to an average car journey, which amounts to RM1.07 billion in lost productive time. Unattended, these costs will increase substantially because the Malaysian economy is highly-transport intensive. A large part of GDP is traded and the bulk of import intensive manufactured goods are exported. Moreover, a large number of people now commute longer distances to work. If the target growth rate of 7 percent per annum over the next thirty years is to be met, the size of the freight and passenger vehicle fleets would increase two and half times and emissions from road transport would triple, especially in urban areas. The time lost in traffic jams in Kuala Lumpur could easily rise to twice the current level, which will be a staggering additional cost to business.

42. A two-pronged approach consisting of short and medium term measures is recommended for designing a cost-effective strategy for transport related pollution.

Short-term Measures

- More Stringent Emissions Standards. Advanced emissions standards could reduce emissions from private cars by 74 percent by the year 2000 at an average cost of RM 515 million per annum. This is a small proportion of the health expenses that would be avoided by reducing human exposure to pollution. The pay-off from more stringent emissions standards is even higher for two-stroke engine motorcycles that constitute at least 50 percent of the motorcycle fleet and account for a third of all transport related pollution. Tougher emissions standards for diesel vehicles would reduce sulphur dioxide and particulate emissions substantially.

- Credible Inspection and Maintenance Program. Systematic inspection and maintenance of vehicles should be enforced. This will reduce emissions more than relying exclusively on certification by manufacturers. Regular inspection has reduced carbon monoxide emissions in the U.S by 25 percent and nitrogen oxide emissions by 10 percent.

- Promotion of Unleaded Gasoline. Lead emissions from an expanding vehicle fleet will have serious health implications and must be curbed. The ban would impose a modest cost relative to the benefits. This report estimates that a ban on unleaded gasoline in 1992 would have increased the cost of gasoline by RM 0.06 per liter; the total price tag of the ban would have amounted to RM 213 million. This is just a fraction of the savings from reduced exposure to lead.

- Rationalizing Fuel Prices. Fuel price increases should be phase-in to reflect environmental considerations. At present, fuel prices in Malaysia are half the OECD levels (except the U.S.) and are even lower than in Singapore and Thailand. This increases demand for road transport and contributes to pollution emissions. This report estimates that increasing fuel prices to Singapore levels (by levying an energy tax) would reduce fuel consumption by 20 percent and would lower emissions by 18 percent. Combined with an efficient mass urban transit system, a given fuel price increase will result in even larger contraction in demand for travel in low occupancy vehicles and thus will achieve a greater reduction in pollution emissions. Higher fuel prices would also prompt manufacturers to improve the fuel efficiency of vehicles.

Medium-term Measures

- Promoting Four-stroke Engine Motorcycles. Four-stroke engines are far less polluting than two-stroke engines and do not cost much more. Thus, the import/production of four-stroke engine motorcycles should be increased. The two-stroke engine should be phased out gradually to minimize any adverse impact on low income users.

- Public Education Campaigns. The costs of pollution abatement are accepted more easily if the public is informed about the consequences of doing nothing. Public education campaigns, therefore, are crucial in mustering support for pollution control measures. An example is a campaign to strengthen local demand for the less polluting model of the national car, Proton Saga[3/]. This would also remove any conflicts between the national car policy and the Government's urban environment objectives.

- Improving Data and Information Systems. International experience suggests that a range of policy options are available for transport related pollution abatement but that cost-benefit or cost-effectiveness criteria must be applied to tailor policies to specific situations. This requires; first, completion of the program for computerized registration of motor vehicles and its integration with the program for updating emissions inventory and second, collection of data on both the government costs of the emissions control program as well as the costs incurred by vehicle operators.

- Strengthening Institutional Coordination. At present, too many agencies are involved in data gathering and policy formulation, resulting in expensive overlaps. Smooth coordination between the DOE, the Road Transport Department and the Ministry of Energy is particularly important. In this context, the ongoing project on integrated national energy planning (INEP) should pay close attention to the environmental consequences of energy consumption and the DOE and the INEP should develop a common data base and consistent assumptions. Coordination with local governments, such as the Kuala Lumpur City Hall, is also needed since they are important in planning and implementing transport policies for their communities.

- Coordinating Policies within ASEAN. Malaysia's trade within the ASEAN region, but especially with Thailand and Singapore, will continue to

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[3/] The technology exists but is currently available only in export models of Proton Saga.

expand. Much of it will use road transport, so that the DOE should work closely with counterparts in these countries to develop common emissions standards and test procedures.

- Improving Public Transport and Implementing Traffic Restraint Measures. In the long-run, transport pollution abatement requires an efficient management of traffic volume and flows. Improved public transport is one pillar of such a policy. This would have to be complemented by traffic restraint measures, such as discouraging private car entry into city centers through area licensing and parking restrictions, increase in parking fees and rationalization of deliveries.

Improving the Delivery of Urban Services

43. Rapid income growth and urbanization are straining urban service delivery. Although the coverage of clean drinking water in urban areas is high, inadequate sewerage and drainage systems now threaten urban water quality. Moreover, the accumulation of solid waste has outstripped the available safe landfills. To meet the growing demand on the urban infrastructure, annual investments of around US$ 1.5 billion are needed. Actual investments in the Sixth Plan, however, are only one fourth of this. In view of the undesirable environmental consequences of this shortfall, the authorities are seeking public as well as private solutions. In addition, several steps could be taken in the short term to improve the existing facilities.

Short Term Measures

44. Improve Monitoring. Monitoring of the quality of drinking water needs to be tightened. The Ministry of Health is responsible for monitoring drinking water quality (including the bacteriological content) and is in charge of the country's sanitation program. To strengthen its capabilities, the MOH should have the legal power to levy fines on individuals as well as on local authorities for non-compliance with government standards. To complement the MOH efforts, it is recommended that the DOE should regularly monitor and report the bacteriological count in the rivers, and thus fill a gap in its otherwise well-conceived river monitoring system.

45. Municipalities are responsible for monitoring the performance of the sewerage and sanitation treatment facilities. Their role needs to be expanded to include monitoring and reporting on the performance of individual septic tanks and water quality in drains and river sections within the municipality's jurisdiction. It is also recommended that municipalities regularly monitor the condition of solid waste dumps by installing wells where leachates might infiltrate the groundwater or might leak into drains or streams.

Efficiency Improvement

46. There is also room for improving the existing water and sanitation facilities. Some of the recommended measures are; increase employee productivity in the delivery of water, systematic de-sludge tanks in housing developments and implement the ABC program (Action plan for Beautiful and Clean Malaysia) for solid waste removal. These measures do not require significant investment and they are essential interim steps while the longer term strategy for improving the urban environment is being designed.

Medium Term Issues

47. Local Authorities (LAs) are the main protectors of the urban environment since they provide municipal services and are the first level monitors of abuse of standards. However, the LAs in Malaysia are financially distressed and their technical staff are over-stretched. Their budgetary difficulties arise from the increased cost of services, their inability to raise sufficient revenues locally and a tighter fiscal stance that limits federal transfers. In view of these difficulties, the government has decided to privatize sewerage. This will change the role of LAs from direct providers to regulators and monitors of urban services. While this will alleviate the financial and technical burden on LAs, it will need additional training to acquire the regulating and monitoring expertise.

48. Privatization of sewerage is a brave new step. There is little international precedence for this and Malaysia's own past privatization experience, although successful, is not a good guide in handing over a public service to a private monopoly. One thing clear is that while private delivery of sewerage will alleviate the financial burden on the government, continued government presence will be needed to protect the public interest. The process must be transparent to catch potential problems associated with the monopoly at an early stage. Moreover, flexibility should be retained with respect to the pricing formulae so that these can be modified as regulators learn more about the privatization process.

49. Public provision of sewerage and clean drinking water need not be a burden on the public exchequer. A number of lessons can be learnt in this context from the experience of successfully run public utilities in the U.S. Firstly, financial autonomy and accountability of such public utilities is essential, which may be achieved by authorizing the utility to issue public debt (bonds) and subjecting bond issue to independent credit rating. Secondly, the budget process should be transparent and open to public hearings. Thirdly, development charges must be an important component of financing for capital expenditures; new debt servicing should be levied on homeowners in the newly developed areas and not passed on as additions to the general service charge to all consumers. Fourthly, the utility should be subject to strict environmental regulations, particularly regarding bacterial and hazardous material in samples taken from clean and waste water. Fifthly, there are economies of scale (in billing, materials and personnel) in the joint provision of drinking water and sewerage; institutions should be restructured to enjoy these economies.

50. Malaysia would benefit from setting up a pilot public utility in areas earmarked for privatization. Such a utility would provide a data base for regulating the private monopoly. The model public utility would be organized as an autonomous body incorporating the lessons of successful international experience summarized above. Given the constitutional problems in local government finance and the separate responsibilities of the state and local governments in the provision of water and sewerage, the model utility should be located in the federal territory. Residents of the locality should be represented on the board as watchdogs over the utility's budgetary proposals and as monitors of the quality of service provided. The lessons of such an experiment would be invaluable in regulating the private monopoly.

51. Both as a provider of municipal services and as a regulator of private monopoly, the government would need to carry out frequent surveys to inform itself of consumer demand. Such surveys of the willingness-to-pay have been found to be a useful tool for incorporating demand side considerations in the technical design of a service, its coverage and the fees structure. The international experience is that projects that reflect such demand considerations are "owned" by communities they serve. This helps in maintaining the quality of service and strengthens chances of project survival.

52. To conclude, although urban pollution in Malaysia is not as severe as in many other East Asian cities, serious problems are now emerging related to transport emissions and inadequate sewerage facilities. Unattended, these would inflict heavy costs on the economy in terms of output loss due to sickness and traffic congestion. The degradation of the quality of urban living would also threaten Malaysia's attraction to foreign investors and tourists. Clearly, policy makers must weigh the benefits (that would accrue from pollution control policies) against the costs of policies (which include investment in pollution control equipment and in setting up appropriate standards and efficient monitoring systems). The analyses presented in this report demonstrate that the costs of pollution abatement are small relative to the benefits, particularly if the recommended cost-effective strategies are implemented. Malaysia's successful development record rests on a policy management style that anticipates problems before they become crises: On that criterion, the time has arrived for cost-effective pollution control to sharpen Malaysia's long term competitiveness.

I. THE STATE OF MALAYSIA'S URBAN ENVIRONMENT

A: Background

1.1 Malaysia has enjoyed rapid economic growth in recent years, averaging 6.2 percent between 1982-1991. While this has brought increasing prosperity, it has also started to impose costs of industrial pollution and degradation of the urban environment. That Malaysia has not faced the scale of urban degradation seen in the Philippines (Manila), Thailand (Bangkok) and Indonesia (Jakarta) is largely thanks to the policy of locating industry in three conglomerations along the Western coast of Peninsular Malaysia i.e. Johar Bahru, the Klang valley and Penang. However, the fast pace of industrial growth (Table 1.1) and the rapid transition of the economy has started to take its toll in the form of deteriorating quality of air and water.

Table 1.1: Economic Growth Indicators

	1971-80	*1981-86*	*1987-92*
Growth Rates (%)			
GDP	7.8	4.4	8.4
GDP Per Capita	4.9	1.7	5.8
Manufacturing	11.6	5.6	14.6

Source: Economic Report 1992/93, Ministry of Finance, Malaysia.

1.2 The objectives of the report are: (i) to identify the scale of urban pollution in Malaysia as it affects the quality of air and water and the accumulation of toxic waste; (ii) to identify the major sources of pollution in industry, transport and in the form of municipal waste & sewerage; (iii) to suggest cost-effective strategies for pollution abatement; and (iv) to evaluate new policy initiatives for strengthening state and local governments, privatization and institutional reform to improve pollution control and delivery of urban municipal services.

1.3 The basic message of the report is positive and action-oriented. Developed country experience shows that most forms of industrial/urban environmental degradation can be reversed even after long periods of neglect, but at increasing cost. The approach taken in this report thus is to: (a) identify and tackle those problems whose postponement would result in high costs later and (b) suggest low cost control measures relative to their benefits (in terms of avoided health costs and productivity loss).

B. The State of Urban Environment

1.4 Economic growth is associated with industrialization and urbanization that increase the demand for energy, transportation and urban services such as sewerage and municipal solid waste disposal. These five spheres of economic activity in themselves or through their interaction degrade the quality of air and water and lead to the accumulation of hazardous waste. A recent World Bank study shows that such degradation can be substantial and requires policy intervention for correction.[1/]

1.5 The discussion in this section identifies the major forms of urban pollution in Malaysia. It establishes the severity of air and water pollution and outlines the growing problems of municipal solid and industrial hazardous waste. It also identifies the important sources of pollution to set the agenda for the analysis and policy prescriptions in the rest of the report.

Air Pollution

Some Definitions

1.6 Much of the emissions of gases such as carbon mono-oxide, carbon dioxide, methane, nitric oxide, sulphur dioxide and ozone take place naturally and, indeed, are essential for maintaining the quality of ambient air. Pollution is defined as additional emissions of these gases due to human activity. When human activity results in rapid accumulation of stocks beyond levels safe for human beings, or when the flow of emissions results in periodic accumulation that is dangerous to human health, pollution becomes a serious matter and requires attention. Some examples of such pollution are: high concentrations of sulphur dioxide from burning lignite for power generation and consumption of diesel fuel that results in acid rain; accumulation of lead in the atmosphere from fuel burning that affects children's health; excessive emissions of carbon dioxide that contributes to the green house effect; accumulation of chlorofluoro carbons in the upper atmosphere that deplete the upper layer of ozone with disastrous consequences for human beings.

1.7 A growing form of pollution in developing countries is the emission of suspended particulates (SPMs) into the atmosphere. These are fine particles (smaller than 2.5 microns) that are emitted into the air through construction and industrial activity and through motor vehicle emissions. Particulate matter associated with diesel exhaust stay in the atmosphere for a long period of time and contribute to smog, which reduces visibility. Unsafe levels of suspended particles irritate the mucous membrane and may cause respiratory disease including lung cancer.

[1/] Nemat Shafik and Sushenjit Bandyopadhyay, "Economic Growth and Environmental Quality", World Bank Working paper No. 904, June 1992.

Pollution Incidence

1.8 Rapid industrial growth and urbanization, along with a much higher demand for transportation in Asia are beginning to cause severe problems of air pollution. Of the world's most polluted cities in terms of particulate matter, twelve are in Asia (Table 1.2). Regarding sulphur dioxide, the six most polluted cities are in Asia. Kuala Lumpur is among the Asian cities most polluted in terms of particulate matter. Sulphur dioxide emissions are not a serious problem in Malaysia because natural gas is used for most power generation; however, transport related emissions of this dangerous pollutant are on the increase.

Table 1.2: Air Pollution in Asian Cities

Highest levels of particulate matter	*Highest levels of sulphur dioxide*	*Worst ranking by the population crisis committee*
Shenyang	Shenyang	Calcutta
Xian	Seoul	Jakarta
New Delhi	Xian	New Delhi
Beijing	Baijing	Beijing
Calcutta	Manila	Shenyang
Jakarta	Guangzhou	
Shanghai		
Guangzhou		
Illigan city		
Bangkok		
Bombay		
Kuala Lumpur		

Source: World Resources, World Resource Institute, 1988-89 (as quoted in World Bank's Asia Environment Study, 1993)

1.9 Malaysia has set ambient standards for air pollution that are reported in Table 1A.a in the appendix to this chapter. These appear reasonable in international comparisons. However, ambient standards are only a guideline. These are supplemented by actual concentrations of air pollutants to establish how serious the problem is. International comparisons of the concentration of total suspended particulate matter (TSP) are reported in Table 1.3. It can be seen that although concentrations of SPM have declined in the ten year period 1980 to 1990 at the two sites in Kuala Lumpur, the levels are still two to three times higher than in New York and Tokyo. TSP related pollution became a serious problem in 1991 when haze reduced visibility to one kilometer in many areas and TSP levels recorded in some urban centers (Petaling Jaya, for example) reached 300-490 ug/m3.

Table 1.3: International of Comparison of Air Quality: Suspended Particulate matter
Annual mean concentration
(micrograms per cubic meter)

	1979-82	*1983-86*	*1987-90*	*Average Annual Growth Rate*
Beijing (ccc)	475	500	413	-2.7
Delhi (ccc)	460	460		-0.3
Jakarta (ccr)	254	271		2.2
Lahore (sr)	745		496	-5.1
Kuala Lumpur (sc)	172	135	119	-3.9
Kuala Lumpur (si)	155	139	144	-1.5
Bangkok (si)	213	247	244	0.8
Tokyo (ccc)	61	50		-4.9
Tokyo (sr)	54	51		-4.5
New York (ccr)	63	61		-2.2
New York (sr)	49	46		-2.7

Source: World Development Report 1992.

Note: City Center Commercial (ccc)
City Center Residential (ccr)
Suburban Residential (sr)
Suburban Commercial (sc)
Suburban Industrial (si)

1.10 Concentrations of TSP vary by location. Department of the Environment monitors TSP related pollution at 32 sites located throughout Malaysia. The sites are chosen to represent industrial, traffic, commercial and residential zones. The observations made at these sites reveal a growing problem TSP related pollution (Table 1.4). Nearly 53 percent of the centers report TSP concentrations that exceed Malaysia's own guideline of 90 micrograms per cubic meter per 24 hours (Environment Quality report, 1990). The most frequent violations were located in areas with heavy traffic, followed by industrial, commercial and residential centers (in that order). In terms of regional concentration, the most serious violations are in Petaling Jaya, Senawang and Kuantan, followed by Pasir Gudang, Kuala Lumpur and Shah Alam.

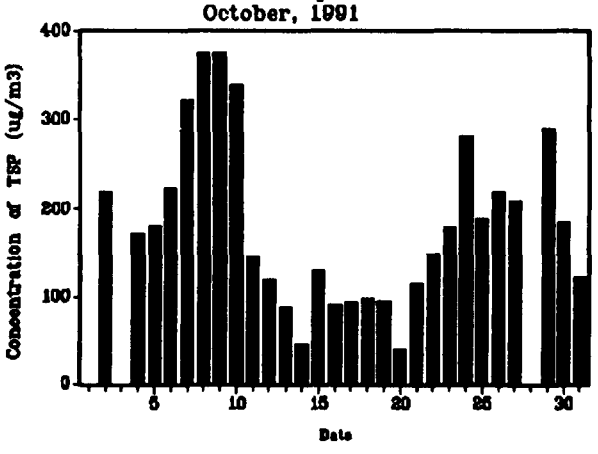
Table 1.4: Excessive TSP Readings By Location
(Percentages)

	Number of times guidelines exceeded						
Type of site	*0*	*1*	*2*	*3*	*4*	*5*	
Industrial	*47.3*	*16.6*	*6.7*	*11.9*	*17.4*	*0.0*	*100*
Traffic	17.7	4.3	38.0	0.0	17.0	23.0	100
Commercial	52.6	24.1	0.0	23.3	0.0	0.0	100
Residential	69.2	10.4	0.0	20.4	0.0	0.0	100

Source: Environmental Quality Report, 1990

1.11 Especially harmful to human well-being are fine particles in the atmosphere known as PM10s (particulate matter less than in 10 microns in diameter). These fine particles are easily inhaled and their high concentration can seriously damage the respiratory system. This form of pollution increased alarmingly during the haze of October 1991, reaching 340 ug/m3 in Kuala Lumpur.

Figure 1.1: Petaling Jaya: Concentration of Total Suspended Particulates October, 1991



Source: EQR, 1991.

1.12 Sulphur dioxide, beyond the safe threshold (WHO guidelines put it at long term (1 year) concentration of 50 micrograms per cubic meter), is an irritant; it exacerbates asthma and bronchitis and impairs the lungs. It is also a major cause of acid rain which affects vegetation and physical structures.

Fortunately, this is not a serious problem in Malaysia. The annual mean concentration of sulphur dioxide at 24 (in Kuala Lumpur) is well below WHO standards (Table 1.5). However, the rapid increase in diesel engine driven road transport has caused SO_2 emissions to rise.

Table 1.5: International Comparison of Air Quality: Sulfur Dioxide Annual mean concentration
(micrograms per cubic Meter)

	1979-82	*1983-86*	*1987-90*	*Average Annual Growth Rate*
Beijing (ccc)	77	119	107	35
Delhi (ccc)	42		86	12
Kuala Lumpur (si)	12	24		12.4
Bangkok (sr)	15	15	14	-1.7
Tokyo (ccc)	42	23	20	-8.9
Tokyo (sr)	42	30	20	-7.7
New York (ccc)	79	60		-5.8
New York (sr)	38	31		-5.9

Source: World Development Report 1992.

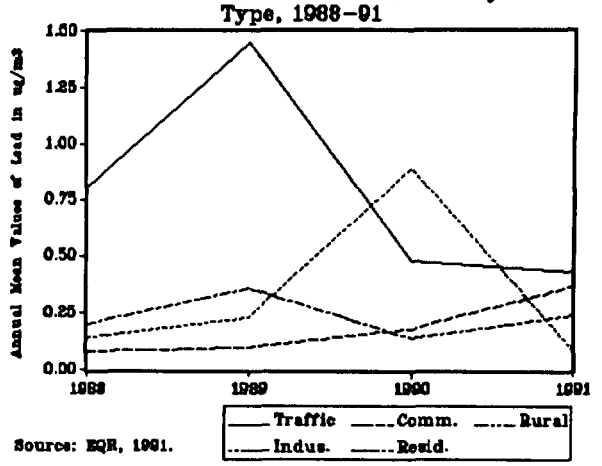
Note: City Center Commercial (ccc)
City Center Residential (ccr)
Suburban Residential (sr)
Suburban Commercial (sc)
Suburban Industrial (si)

1.13 Lead is added to gasoline to boost its octane rating. It is emitted into the air through auto exhaust and is a particularly harmful SPM. Unsafe levels (WHO guidelines put the safe level at below the mean annual range of 0.5 to 1 micrograms per cubic meter) of lead concentration in the air is very injurious to health. It affects the circulatory, nervous and reproductive systems and reduces the learning ability of children. It is ingested through the lungs and the gastrointestinal tract. Lead concentration in Malaysia are high but readings taken by the Department of Environment show consistent and steady improvement (Figure 1.2) in lead emissions.

Source of Air Pollution

1.14 The three main sources of air pollution are mobile sources (transport), stationary sources (power stations, industrial fuel burning and processes and domestic fuel burning) and the burning of municipal and industrial waste. Together, they emitted 911,240 tons of pollutants into the air in 1991. These were in the form of particulates sulphur dioxide, nitrates, carbon monoxide and hydrocarbons. Mobile sources are by far the largest source of emissions accounting for 75 percent of total emissions (Figure 1.3). Their emissions continue to increase; between 1987-91 mobile emissions load increased 11.8 percent. Because of the switch to cleaner fuels, power sector emissions fell 16.8 percent during this period.

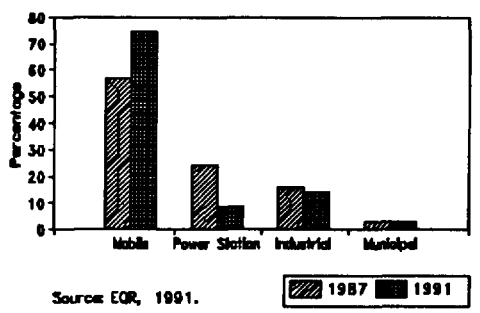
Figure 1.2: Status of Air Quality, Annual Mean Values of Lead by Area Type, 1988-91



Source: EQR, 1991.

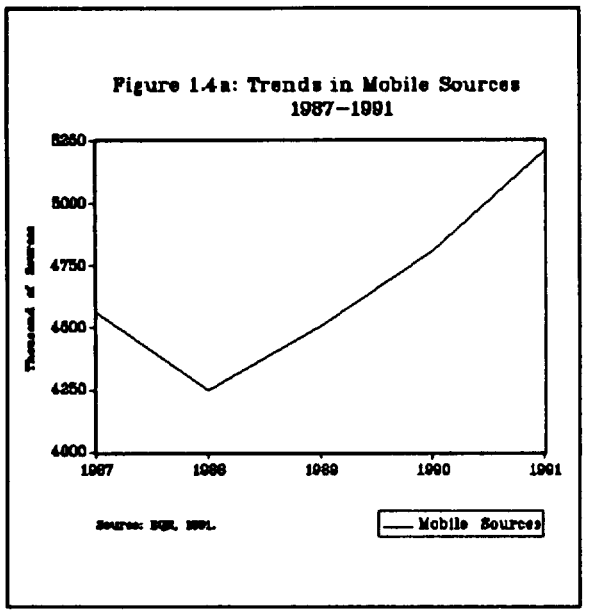
1.15 Industrial air pollution emissions load appears to have remained unchanged, which is surprising given the rapid rate of industrial growth. However, industry's main pollutants are discharged into water or take the form of toxic and hazardous waste, which is discussed in the next section. The growing problem of municipal waste and its safe disposal is seen in the four percent increase in the air emissions load due to open burning of municipal waste.

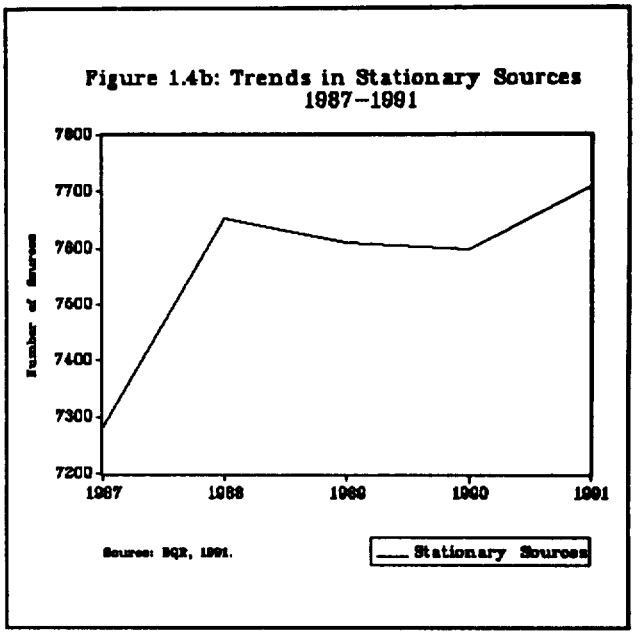
Figure 1.3: Emission of Pollutant to the Atmosphere by Sources (Uncontrolled



Source: EQR, 1991.

1.16 The complexity of policy design for redressal of pollution increases if the sources of pollution are many and diverse. That appears to be the case in Malaysia. Department of the Environment identified 5.2 million sources of air pollution in 1991. Of these 7711 are stationary (industry, power generation), 80 are solid waste disposal related and the remaining overwhelming majority are mobile. Figure 1.4a and 1.4b report the trends in the number of stationary and mobile sources in the period 1987-91.





Water Pollution

1.17 Water pollution is measured in terms of concentration of disease-carrying fecal coliform, dissolved oxygen and the presence of heavy metals and other hazardous material. The scale of the problem can be appreciated from the following example: the coliform count in river Yamuna before it enters New Delhi is 7,500 per 100 millimeters (mls) and it reaches a staggering 24,000,000 per 100 ml when it leaves the city.[2/]

1.18 The principal source of fecal coliform is human waste, while levels of dissolved oxygen in water are affected by industrial waste and agricultural run-off. The focus of discussion in this report is the pollution of river water, but these sources also affect underground water reservoirs due to seepage from storage and septic tanks.

1.19 The presence of diseased fecal coliform in water poses severe health hazards for human beings in the form of diseases such as typhoid, cholera, diarrhea, roundworm, Guineaworm and schistosomiasis. These conditions have both direct as well as indirect health effects through depletion of body strength and increased vulnerability to other illnesses. Substantial health benefits are associated with reducing water pollution. The U.S. Agency for International

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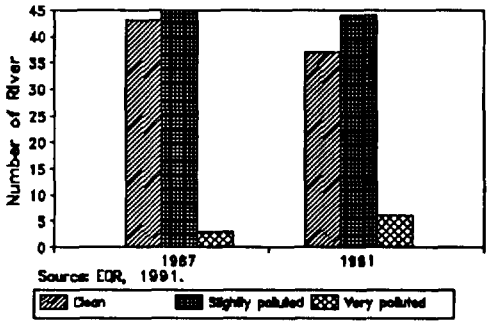
[2/] E. Shin et al, 1992, " Economic Valuation of Urban Environment Problems".

Development (USAID) reports a 22 percent, 28 percent, 76 percent and 73 percent reduction, respectively, in the incidence of diarrhea, roundworm, Guineaworm and schistosomiasis following improvement in the quality of water and sanitation. The mean reduction in the incidence of diarrhea related morbidity due to improvement in water quality alone was nearly 16 percent.

1.20 The reduction of dissolved oxygen in water due to contamination from industrial waste and run-off of fertilizer and chemicals used on the farm effects mainly plant life and fish. Indirectly, it affects humans also via consumption of poisoned fish. The benefits from reducing this source of pollution are in the form of improvement in human health, but also because bio-diversity would be sustained, which has intrinsic value.

1.21 River pollution in Malaysia has increased over time. The Department of Environment regularly monitors the quality of water in selected Malaysian rivers. The ambient standards for water pollution are set in terms of indexes measuring biological oxygen demand (BOD caused by organic pollution), ammoniacal nitrogen (NH3-N emitted in the form of sewage and animal waste or fecal coliform) and suspended solids (See Table 1A.2 in the appendix to this chapter). These are consolidated into an overall water quality index to sort out rivers as clean, slightly polluted and very polluted. Figure 1.5 reports that the proportion of slightly to highly polluted rivers has increased in the period 1987-91. On Peninsular Malaysia, 25 rivers were highly polluted due to NH3-N and 29 due to suspended solids.

Figure 1.5
River Water Quality Index



Source: EQR, 1991.

1.22 International comparisons of dissolved oxygen in selected rivers confirm that rivers in Malaysia are highly polluted (Table 1.6). With average mean concentration of dissolved oxygen at less than 3.5 milligrams per liter, this form of pollution in Malaysia is well above internationally acceptable levels of around 6 milligrams per liter.

Sources of Water Pollution

1.23 Data on sources of river pollution are available only for BOD discharge and they show that most (79%) of it is accounted for by sewage (Table 1.7); the share of industry and agriculture being 8 percent and 13 percent respectively. Total BOD discharge has increased over time in Malaysia (Figure 1.6) and sewage has contributed the most to this increase.

Figure 1.6: BOD Load Discharged by Sewage 1987-1991

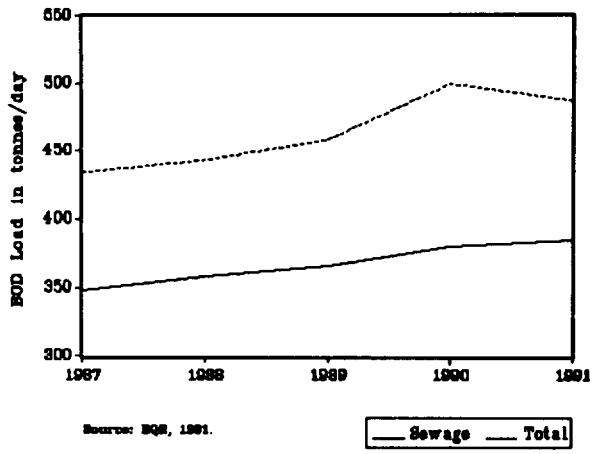


Table 1.6: International Comparison of Water Quality: Dissolved oxygen Annual mean concentration
(milligrams per liter)

	River, City	*1979-82*	*1983-86*	*1987-90*	*Average Annual Growth Rate (%)*
China	Yangtze, Shanhai	8.3	8.3	8.2	-0.1 (11)
China	Yellow Beijing	9.8	9.7	9.8	-0.1 (11)
India	Godavari, Dhalegaon	6.5	6.6	6.7	0.3 (9)
India	Subanarekha, Ranchi	6.7	4.0	5.3	-6.2 (9)
Pakistan	Ravi, d/s frm Lahore	6.8	5.7	6.3	-1.4 (12)
Pakistan	Indus, Kotri	7.6	7.2	2.6	-13.6 (11)
Malaysia	Klang	3.0	3.3	2.8	-1.1 (9)
Malaysia	Linggi	3.4	3.6	3.7	0.9 (10)
Thailand	Chao Phrya, d/s	6.3	6.3		0.2 (8)
Thailand	Nakhon	6.6	7.7		8.0 (5)
Japan	Prasak, Kaeng Khoi	10.1	10.3	10.3	0.2 (10)
Japan	Yodo, Hirakata Brdg	10.0	10.6	11.7	1.7 (11)
U.S	Kiso, Asahi	11.1	10.6		-2.5 (70)
U.S.	Delaware, Trenton, NJ	9.8	12.1		7.2 (7)
	Hudson, Green Isl, NY				

Source: World Development Report 1992.

Table 1.7: BOD Load By Source

	1987	*1991*	*1987-91 (% change)*
Total in tons per day	434	487	11.2
Of which			
Ag. industry	11	12	10.9
Manufacturing	20	25	12.5
Agriculture	55	65	11.8
Sewage	348	487	14

Source: EQR, 1991.

1.24 Inadequate sewerage system is the main cause of water pollution. In 1990, nation-wide 5 percent of households were connected to centralized sewerage, while 37 percent are connected to communal septic tanks, 45 percent have pour flush system, 4 percent use pit-latrine, 1-2 percent use the bucket system and 6 percent households have no-facilities at all.

1.25 Sewerage coverage is somewhat better in large cities. For example, in Kuala Lumpur, 40 percent of the households are connected to a centralized sewerage system and the other 60 percent are connected to communal septic tanks. (In Malaysia, collective housing units of more than 30 households are required to have collective septic tanks, while those smaller than 30 households are allowed to have individual septic tanks).

1.26 The central waste water treatment facility in Kuala Lumpur was built about 40 years ago using British technology. Lagoons were added in the late 1970s. Sludge produced by the older facility is composted and used by the city's gardens. Sludge in the Lagoons at present remains on site.

1.27 Water pollution by industry, the second most important source of such pollution, is widespread. The DOE has identified 9992 source of industrial pollution in Malaysia with pockets of high concentration in Slengor, Johor and Pulau Pinang (further details on water pollution by industry are presented in Chapter III).

Solid Waste

1.28 Economic growth in Asia is leading to rapid urbanization and this is also true in Malaysia (Table 1.8). Urbanization is changing Malaysia's land scape and the organization of human settlements. Consumption-oriented urban life style imposes a heavy load on urban solid waste and thus on the urban environment's natural capacity to cleanse and rejuvenate itself. Table 1.9 shows that on a per capita basis, solid waste generated in Kuala Lumpur is quite high compared to other Asian countries.

Table 1.8: Estimated Population and GDP of Urban Economies in Selected Asian

Country	*Urban share of population, 1990*	*Share of Urban GDP in Total, 1985*
Bangladesh	16	32
China	33	48
Indonesia	31	37
Korea	72	79
Malaysia	43	37
Philippines	43	53
Pakistan	32	47
Sri Lanka	21	42
Thailand	23	41

Source: ESCAP, 1990; UN Urbanizing Prospects, quoted in the Asia Environment Study.

Table 1.9: Solid Waste Generated in Asian Cities

City	*1000s of tons per year*	*kgs per capita per day*
Seoul	10512	2.80
Beijing	3580	1.59
Jakarta	1800	0.75
Bangkok	1800	0.88
Manila	1380	0.50
Bombay	1150	0.55
Kuala Lumpur	730	1.29
Colombo	160	0.75

Source: UNCRD, 1989, quoted in Asia Environment Report, 1993.

1.29 Poor solid waste management causes micro-biological diseases and flooding of streams by dumped garbage. In 1988, 10 percent of municipal households did not have public solid waste removal services, while 20 percent were not served in other districts. In 1987, urban municipal solid waste per capita ranged from 0.495 kilograms to 1.29 kilograms. Except for one city where an incinerator is used, landfills are the final destination of municipal solid waste.

1.4 Hazardous Waste

1.30 Hazardous or toxic waste is a by-product of industrialization and consist of a vast array of items such as heavy metals (arsenic, copper, lead, mercury, zinc and cadmium are monitored in Malaysia) and materials that are reactive, toxic, ignitable, radioactive, infectious and corrosive. Improper handling of hazardous waste can result in air, water as well as soil pollution. At present, industrialized countries typically generate 5000 tons of hazardous waste for every billion dollars of GDP. In developing countries, hazardous waste generation is quite uneven. For example, Singapore and Hong Kong combined generate more toxic waste in their industrial production than all of Sub-Saharan Africa (excluding South Africa). Future trends, however, are alarming. At present trends, China, India, Korea and Turkey will reach the current levels of hazardous waste production in the U.K. and France in about fifteen years.

1.31 Exposure to hazardous waste is rarely widespread but local consequences can be catastrophic as in the case of mercury poisoning in Japan and increased incidence of cancer in love canal in the U.S. etc. While the cacogenic consequences of exposure to hazardous substance do not appear to be substantially larger than those of naturally occurring carcogenes, there may be serious and as-yet-not-well-understood consequences of new compounds that are produced.

1.32 Information on the quantity of hazardous waste generated in Malaysia is somewhat dated. The estimates for 1987 put hazardous waste generation at 390,000 cubic meters. The estimated generation rate in 1992 was 1.08 million cubic meters per year. As a comparison, it is estimated that Thai industries produced 2 million tons of hazardous waste in 1990 which will increase to 6 million tons by 2000. More details are presented in Chapter 3 on industrial pollution.

C. Environmental Legislation and the Budget

1.33 Malaysia's current policy for industrial/urban pollution control is guided by a comprehensive set of legislation. The Environmental Quality Act, 1974 contains the provisions regarding air pollution, noise pollution, pollution on land, pollution of inland waters and oil pollution. Fifteen regulations have been promulgated under the EQA, 1974 (Table 1.10), the latest of which are aimed at checking the increasing problem of hazardous waste.

1.34 The 1974 Act also created the Department of Environment (DOE) in the Ministry of Science and Technology with the responsibility of monitoring compliance to the legislation and taking steps to enforce it. The DOE carries out this responsibility with a staff of 490 (1991), of which 290 have professional or sub-professional qualifications. Owing to increasing demand, DOE staff is now fully stretched. The success in this essentially command and control approach to pollution control and the new demands placed on DOE staff are analyzed in detail in chapter 3.

1.35 At present, the government spends only a modest amount on environmental protection. Budgetary allocations in 1991-93 have averaged RM 108 million per year which is 0.08 percent of the average GDP in these years (Table 1.11). Developed country budgetary allocations for pollution control are only slightly larger; the Japanese government spent 0.3 percent in 1990. Note, however, that these are just the costs incurred by the government; compliance costs incurred by the polluters are much higher, as much as 1.3 to 1.5 percent of GDP in Japan and the U.S. Thus, public and private costs of pollution abatement, taken together, could reach 2 percent of GDP. This is substantial and requires care in choosing policies that are the most cost-effective in terms of their abatement results.

Table 1.10: List of Regulations and Orders Enforced by the Department of Environment

Regulation/Order	*Effective Enforcement Date*
Environmental (Prescribed Premises) (Crude Palm Oil) Order 1977	1 Jul 1978
Environmental (Prescribed Premises) (Crude Palm Oil) Regulations (1977 Amendment (1982)	4 Nov 1977
Environmental Quality (Licensing) Regulations 1977	1 Oct 1977
Motor Vehicles (Control of Smoke and Gas Emissions) Rules 1977 (made under the Road Traffic Ordinance, 1958)	22 Dec 1977
Environmental (Prescribed Premises) (Raw Natural Rubber) (Amendment) Order 1978	1 Apr 1979
Environmental (Prescribed Premises) (Raw Natural Rubber) Regulations 1978 Amendment (1980)	1 Dec 1978
Environmental Quality (Clean Air) Regulations 1978	1 Oct 1978
Environmental Quality (Compounding of Offences) Regulations 1978	1 Oct 1978
Environmental Quality (Sewage and Industrial Effluents) Regulations 1979	1 Jan 1979
Environmental Quality (Control of Lead Concentrations in Motor Gasoline) Regulations 1985	11 Jul 1985
Environmental Quality (Motor Vehicle Noise) Regulations 1987	16 Jul 1987
Environmental Quality (Prescribed Activities) (Environmental Impact Assessment) Order 1987	1 Apr 1988
Environmental Quality (Scheduled Wastes) Regulations 1989	1 May 1989
Environmental (Prescribed Premises) (Scheduled Wastes Treatment and Disposal Facilities) Order 1989	1 May 1989
Environmental (Prescribed Premises) (Scheduled Wastes Treatment and Disposal Facilities) Regulations 1989	1 May 1989

Source: Environment Quality Report, 1991.

Table 1.11: Allocation for Environmental Management and Conservation 1991-1993
(RM million)

	1991	*1992*	*1993*
A		Development Expenditure	
1. Science, Technology and Environment	8.44	16.72	13.50
2. Primary Industries	22.54	19.59	21.69
3. Agriculture	5.40	32.69	59.18
4. Local Government	5.71	6.40	6.40
Total	42.09	75.40	100.77
B		Operating Expenditure	
1. Science, Technology and Environment	21.43	25.42	29.53
2. Primary Industries	9.54	9.36	10.18
Total	30.97	34.78	39.71
Overall Total (A+B)	73.06	110.18 (+50.8%)	140.48 (+27.5%)

Note: Figures in parentheses are percentage change over the previous year.

Source: The Treasury, Government of Malaysia

D. An Outline of the Report

1.36 The previous two sections set the stage for the report. It was established in section A that the transport sector is the main polluter of air and inadequate municipal services (sewage and solid waste disposal) are the principal polluters of water. Industry, while being the most important polluter in terms of hazardous waste, also contributes to water and air pollution. Table 1.12 summarizes the priority sectors for policy action aimed at reducing urban pollution and sets the agenda for the report.

Table 1.12: Priority Sectors By Type of Pollution

	Types of Pollution			
	Air	*Water*	*Hazardous waste*	*Municipal waste*
Priority sectors	1. Transport	1. Sewerage services	Industry	Solid waste & sewerage services
	2. Industry	2. Industry		

1.37 The methodological approach for pollution abatement in the priority sectors (as suggested in section B) is as follows: Pollution control targets, and the policies associated with them, can range from high to zero tolerance for emissions. The former requires doing nothing and thus shifts the cost of clean up to future generations, rendering some of them prohibitively high. The latter implies shutting down all industrial activity and is not viable. The feasible range falls in the middle and requires a careful evaluation of costs and benefits of pollution control measures. To the extent possible, a cost-benefit approach is taken in this report to recommend policy change. However, it is often difficult to measure benefits. The alternative approach then is to minimize the costs of meeting pollution abatement targets. Such cost effective strategies are identified. Where relevant, the report draws on lessons from the successes and failures of Japan and other OECD countries in pollution abatement.

1.38 Following the approach outlined above, the report estimates the health costs of exposure to various forms of pollution (Chapter II) and presents estimated benefits of moving to lower levels of pollution. The pollution profiles of industry and transport sectors, an evaluation of current abatement measures and recommendations for additional cost effective measures, are presented in Chapters III (Industry) and IV (Transport). Chapter V (Municipal Services) evaluates the coverage and performance of drinking water, sewerage and solid waste services in urban Malaysia and briefly evaluates the privatization option in light of emerging financial difficulties and local government weaknesses. The usefulness of conducting regular willingness-to-pay exercises for determining adequate charges for services is illustrated with a small survey.

A Word on Power Generation

1.39 This report does not address the pollution consequences of power generation, which is the most important source of environmental damage in many countries. There are three reasons for this. The first is that even though demand for electricity is increasing rapidly in Malaysia, it is produced with relatively clean fossil fuels (oil and gas, see Table 1.13). Moreover, Malaysia

is fortunate in its huge endowment of natural gas reserves that are expected to last 40-50 years at current demand projections. The share of natural gas in electricity generation is already high and is expected to increase to 80 percent in the year 2000. Natural gas does, of course, contribute to CO_2 emissions and the associated green house effect but that would have be addressed in another report.

Table 1.13: Fuel Sources for Power Generation

FOSSIL FUEL	*INSTALLED (MW)*	*DERATED (MW)*	*ENERGY CAPABILITY (GWh)*
Oil	1095		
Gas/Oil	1200		
Gas/oil/coal	600		
Gas	900		
Total Fossil Fuel	3795	3592	20673
Hydro	1253	1253	3898
TOTAL	5048	4845	24571

1.40 The second reason is that power generation is a relatively smaller share in energy consumption and pollution emissions than the transport sector. This is because power generation technology is more efficient in energy consumption compared to combustion engines in the transport sector. Moreover, the power sector's air emissions (mainly in the form of NOx and SOx) have declined sharply from 24.8 percent of total emissions in 1987 to 8 percent in 1991. Total emissions will continue to fall as cleaner technologies and fuels are incorporated in new power plants.

1.41 The third reason is a practical one. Further pollution abatement in the power sector now requires rationalizing energy use through a mix of more efficient technology at the plant level (such as boilers and furnaces that are less wasteful of energy) and electricity pricing policies that conserve household and industry demand for power. This requires energy auditing and would the topic for another study.

Table 1A.1: Comparison of Ambient Air Quality Standards/Guidelines

	MALAYSIA			*WHO*			*JAPAN*			*PHILIPPINES*			*THAILAND*			*INDONESIA* ***		
	Time	*ppm*	*mg/m³*	*Time*	*ppm*	*mg/m³*	*Time*	*ppm*	*mg/m³*	*Time*	*ppm*	*mg/m³*	*Time*	*ppm*	*mg/m³*	*Time*	*ppm*	*mg/m³*
OZONE	*1 hr.*	*0.10*	*200*	*1 hr.*	-	*150*	*1.hr*	*0.06*	*118*	*1 hr.*	*0.06*	*120*	*1 hr.*	-	*0*	*1 hr.*	*0.10*	*200*
	8 hr.	0.06	120	8 hr.	-	100							8 hr.	-				
CARBON MONOXIDE	1 hr.	30	35,000	1 hr.		30,000				1 hr.	30	35,000	1 hr.	-	50,000	-		
	8 hr.	9	10,000	8 hr.		10,000	8 hr.	20	22,800	8 hr.	9	10,000	8 hr.	-	20,000	8 hr.	20	22,600
							24 hr.	10	11,400									
NO_x (AS NO_2)	1 hr.	0.17	320	1 hr.	-	400				1 hr.	0.10	190	1 hr.	-	320			
				24 hr.	-	150	24 hr. (Range)	0.04-0.06	75-113							24 hr.	0.05	92.5
SO_x	10 min.	0.19	500	10 min.	-	500												
	1 hr.	0.13	350	1 hr.	-	350	1 hr.	0.10	267	1 hr.	0.32	850				1 hr.		
	24 hr.	0.04	105				24 hr.	0.04	107	24 hr.	0.14	369	24 hr.	-	300	24 hr.	0.10	260
													1 hr.	-	100**			
TOTAL SUSPENDED PARTICLES (TSP)	24 hr.	-	260							24 hr.	-	180	24 hr.	-	330	24 hr.	-	260
	1 hr.	-	90							1 hr.	-	250	1 hr.	-	100**			
PARTICU-LATES (PM10)	24 hr.	-	150				24 hr.	-	100									
	1 hr.	-	50				1 hr.	-	200									
LEAD	3 mon.	-	1.5							3 mon.	-	1.5(P)						
				1 hr.	-	0.50							24 hr.	-	10	24 hr.	0.06	60
DUSTFALL	1 hr.	-	133 *															

* mg/m²/d.
** Geometric mean value
*** 1988

Table 1A.2: Malaysia: Water Quality Classification Based on Index Values

Parameter	*Index Range (%)*		
	Clean	*Slightly Polluted*	*Very Polluted*
BOD	> 90	80 - 90	< 80
Ammoniacal Nitrogen	> 91	71 - 91	< 71
Suspended Solids	> 75	70 - 75	< 70

Note: The Indexes for water quality are derived by the DOE using mathematical formulae.

Source: Environment Quality Report, 1991.

II: HEALTH IMPLICATIONS OF URBAN POLLUTION

2.1 There are many potential benefits of reducing urban pollution such as improvement in health due to lower exposure to hazardous emissions and lower costs of maintaining the supply of clean drinking water due to improved sanitation. The benefits of pollution control measures in the transport sector that result in reduced congestion are also significant. The health benefits are the topic of this chapter. The benefits in terms of reduced congestion and improved sanitation are discussed in Chapter's IV and V respectively.

2.2 Malaysia has enjoyed considerable improvements in health in the past twenty years: Infant mortality rates have declined and life expectancy has increased. But, prosperity, industrialization and a faster, more demanding pace of life bring to the fore such new diseases as hypertension and coronary heart problems - diseases that worsen when the urban environment degrades due to pollution. Urban pollution also leads to new forms of illness. High concentrations of particulate matter, sulphur dioxide and nitrous oxide in the air exacerbates respiratory dysfunctions. Lead in the atmosphere is particularly harmful to children. Polluted water systems lead to illnesses of the digestive tract and exposure to hazardous waste increases the risk of cancer.

2.3 In addition to their health effects, these diseases impose substantial costs on individuals. In Malaysia, given universal health coverage by the government, costs of pollution related illnesses are ultimately borne by tax payers. Even larger than the direct costs is the value of lost output due to absence from work. These costs, or the benefits of avoiding them, are large enough to justify a broad range of interventions for pollution abatement (World Development Report, 1992).

2.4 This chapter estimates direct and indirect costs of the major forms of pollution in Malaysia. The method adopted is to first estimate the population exposed to various forms of pollution; this is followed by calculations of illness incidence using dose response functions adapted to Malaysia. Dose response functions estimate the health impact of reduced pollution. The costs of morbidity and mortality associated with pollution related illness are then estimated. The reduction in such costs constitute the benefits of pollution abatement. Air pollution abatement benefits are presented in Part A, water pollution in Part B and hazardous waste in part C. Some recommendations are made in part D.

2.5 It is important to state at the outset that the health impact estimates presented in this chapter are illustrative rather than definitive. This is because the information base that establishes the relationship between pollution and health is weak. In Malaysia, moreover, basic health data to calculate health impacts of pollution are not always available. Thus, on occasion, strong assumptions have been made to tailor other country data to Malaysia. Given these problems, the objective of the discussion in this chapter is to present a rough estimate of how large the savings can potentially be from pollution abatement. Another objective is to demonstrate a methodological approach that is gaining international acceptance for measuring benefits from

pollution abatement. Such exercises also underscore the need to refine the data base on health consequences of pollution in order to give greater precision to such benefit measures.

A. Health Implications of Air Pollution

Exposed Populations

2.6 This section presents populations exposed to TSP (Total Suspended Particulates) and lead in the states of Pulau Pinang, Perak, Selangor, Johor, and the Federal Territory of Kuala Lumpur.

2.7 In 1991, TSP levels increased up to three times above the normal levels during the last haze episode reportedly caused by the forest fire in Indonesia (DOE, 1992). Between October 8 and 11 of 1991, TSP concentrations were between 300 and 490 ug/m3 at Petaling Jaya, compared to the range of 90 to 150 ug/m3 during the non-haze period. Visibility in the highly affected areas dropped to less than one kilometer. The highest annual mean TSP concentration --312 ug/m3-- was recorded in Perak. In most cities, annual mean TSP concentrations in traffic and industrial areas were higher than in commercial or residential areas.

2.8 Table 2.1 shows annual mean TSP concentrations by state and area type. Preliminary estimates of the 1991 population census are that there are 1,065,075 people in Pulau Pinang, 1,880,016 people in Perak, 1,145,075 people in Kuala Lumpur, and 2,074,297 people in Johor. Because populations move from one area type to another during the day (for example, from one residential area to a commercial or industrial area through a traffic area and back to a residential area), it was assumed that the average concentration to which people are exposed is the arithmetic average of the area type concentrations. As shown in Figure 2.1, all averages are above the 90 ug/m3 recommended Malaysian guideline.

Table 2.1: Populations Exposed to Annual Mean TSP Concentrations

STATE	*ANNUAL MEAN TSP*	*EXPOSED POPULATION*
AREA TYPE	*CONCENTRATION (ug/m3)*	
Pulau Pinang		
Industrial	157	-
Residential	72	-
Traffic	167	-
Commercial	90	-
Average	121.5	1,065,075
Perak		
Industrial	312	-
Commercial	160	-
Average	236	1,880,016
Kuala Lumpur (Federal Territory of)		
Traffic	202	-
Commercial	130	-
Residential	61	-
Average	131	1,145,075
Johor		
Industrial	105	-
Traffic	146	-
Commercial	107	-
Average	119	2,074,297

Source: DOE, 1992 and Census, 1991

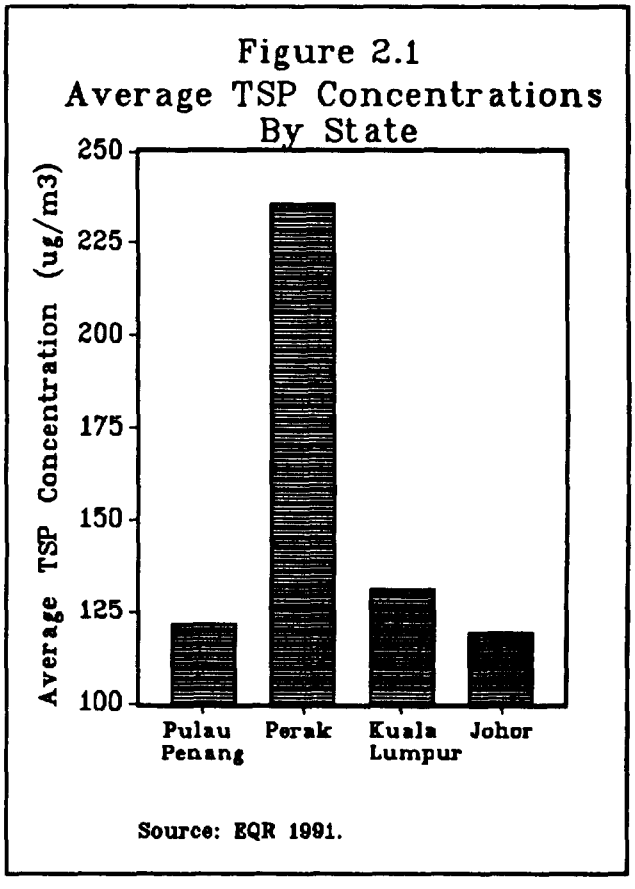
2.9 The analysis assumes that all population is exposed to the mean level of TSP concentration. This assumption might result in under or overestimating the exposed populations. A more rigorous approach would be to use wind patterns and meteorological data to determine populations exposed to concentrations recorded at each monitoring station.

2.10 Table 2.2 shows annual mean lead concentrations by monitoring station. Preliminary estimates of the 1991 census shows that there are 1,145,075 people in Kuala Lumpur, and 2,289,236 people in Selangor. As in the analysis for TSP, it is assumed that the average lead concentration to which people are exposed is the arithmetic average of the area type concentrations.

Table 2.2: Population Exposed to Annual Mean Lead Concentrations

STATE / *AREA TYPE*	*ANNUAL MEAN LEAD CONCENTRATION*	*EXPOSED POPULATION*
Selangor		
Residential	0.21	-
Industrial	0.30	-
Average	0.26	2,289,236
Kuala Lumpur		
Residential	0.13	-
Commercial	0.37	-
Traffic	0.60	-
Average	0.37	1,145,075

Source: DOE, 1992 and Census, 1991



Health Implications

2.11 Particulate matter (TSP), especially the more respirable particles smaller than 10 microns in diameter (PM_{10}), causes a variety of respiratory problems (EPA, 1991). These include increased incidence of respiratory disease, especially in children; aggravation of existing respiratory diseases, particularly bronchitis; reduced resistance to infection; and reductions in lung function. Epidemiological studies demonstrate that airborne particulate matter can cause premature mortality, particularly in elderly and ill persons. Particulate matter also causes various lesser effects such as irritation of the eyes and throat.

2.12 Children six years old or younger are generally considered to be highly vulnerable to airborne lead (EPA, 1991). As levels of lead in blood increase, children have been found to experience a wide range of effects such as: neurobehavioral problems, lower intelligence quotients, and anemia. In addition, several studies indicate that at high concentrations lead may be carcinogenic.

2.13 There is anecdotal evidence that air pollution in Malaysia has serious health implications. For example, atmospheric haze has increased the number of respiratory illnesses. Public hospitals have reported a 10 to 15 percent increase in the number of admissions, private clinics and doctors report even larger increases. The incidence of asthma attacks has also risen.

2.14 There are very few studies in Malaysia that estimate the effect of TSP pollution on health. Two recent studies by the Ministry of Health (MOH) did not find any health effects of TSP pollution because they were too qualitative and exploratory and did not take into account epidemiological evidence from private general practitioners and hospitals.

- The first study (Mahathevan, 1985) was conducted in response to a press report ("The Star" dated April 25, 1984, under the heading "Children in the Klang Valley Hit by Pollution") that several doctors in Petaling Jaya had claimed that 80 percent of their patients over the past six months had developed severe cough and wheezing problems and they had blamed it on the polluted air. MOH decided to do a retrospective study to verify whether there was any indication of an increase of respiratory diseases in the Klang valley. The study concluded that there was no marked increase in respiratory diseases among children and adults in government hospitals and clinics during the six month period prior to the news report. The study was fairly qualitative, however, and did not attempt to correlate ambient concentrations of TSP with hospital admissions due to respiratory problems.

- The second study (MOH, 1992) was commissioned by the Health Sub-Committee on Haze and Air Pollution formed after one of the worst episodes of haze in Peninsular Malaysia in August 1990. The goal of the study was to explore the relationship between TSP levels and selected health effects reported on locally. MOH headed the study with inputs from the Medical Faculties of local universities, DOE, and the Meteorological Services Department. The study concluded that there were no correlation between TSP and the monthly reported incidence of "respiratory diseases" at the three hospitals covered by the study. MOH explained that this retrospective study was purely exploratory and that the three hospitals did not represent the whole Klang valley since many patients go to other government hospitals and health centers, as well as private general practitioners and hospitals. This may be why the findings of this retrospective study seem to be at odds with those of established medical literature.

2.15 Studies comparing lead concentrations in breast milk and blood of Malaysian urban and rural mothers have been more conclusive:

- The first study (Lim, 1983) was conducted to determine lead concentrations in breast milk among urban and rural mothers in Malaysia, and to determine whether lead absorption among urban maternal populations poses a potential health hazard to infants through breastfeeding. Milk samples were collected from 89 urban

and 91 rural mothers. The mean lead level was significantly higher in urban samples (0.0253 ug/ml) than in rural samples (0.0211 ug/ml). The estimated daily lead intake of breastfed infants in Malaysia was well below maximum levels. The study concludes that urban air pollution is one of the factors that contribute to the urban-rural difference. When the study was conducted, the daily average air lead levels in Kuala Lumpur (2.66-5.63 ug/m3) were much higher than in the rural areas (0.21 ug/m3).[1/] Although respired air may contribute only a minor proportion of total lead intake, fallout from pollution may also increase dietary ingestion by contamination of cooked and uncooked foods which are commonly sold and eaten along busy roadsides and congested highways in urban Kuala Lumpur. This may ultimately be an important factor contributing to higher concentrations of lead in body tissues -- including breast milk-- among Malaysian urban women.

- A similar study (Lim, 1985) was conducted to determine blood lead levels in a group of 60 pregnant women living in an urban area and another group of 63 pregnant women from a rural district. The mean blood lead level of the urban women (17.3 ug/100ml) was significantly higher than that of the rural women (15.5 ug/100ml). Although air lead levels in the immediate localities of the clinic populations were not monitored, other studies have demonstrated much higher daily average air lead levels in Kuala Lumpur than in rural areas. Like the previous study, fallout from pollution may contaminate food and drink commonly prepared, sold, and eaten by busy city roadsides.[2/] Automobile emissions may have been a major source of lead in this case, since there were no lead smelting plants or battery factories in the immediate vicinities of the clinic populations.

Dose-Response Functions

2.16 To quantify the reduction in human health effects resulting from reducing ambient concentrations of air pollutants, dose-response functions were used. Dose-response functions relate health impacts to ambient levels of air pollution. These functions estimate the change in health effects expected to occur with continued reductions in ambient concentrations.

2.17 The dose-response functions developed to estimate health effects of TSP and lead pollution abatement in Jakarta were used (Ostro, 1992). The Jakarta study presented a methodology for quantifying the benefits of reducing ambient concentrations of air pollutants. The study also applied the methodology to provide quantitative estimates of associated effects and to demonstrate the

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[1/] The annual levels in Kuala Lumpur are now much lower --less than 0.6 ug/m3.

[2/] In 1993, MOH will conduct a study to measure the lead levels in the food and drink sold in the streets of Kuala Lumpur.

assumptions, data needs, and continued uncertainties involved with using such a methodology. The dose-response functions in the Jakarta study have been identified and adapted from original studies published in the epidemiologic and economics literature. The dose-response functions used in this study are presented in Annex 2A.1. Other pollutants such as ozone, sulfur dioxide, and carbon monoxide are not included because they are not regularly measured in Malaysia.

2.18 It was assumed that the association between ambient concentrations and health effects could be adapted from the original studies. This assumes a similar distribution of background levels of factors such as health status (e.g., incidence of chronic disease, susceptibility of diseases), health care (e.g., access to treatment and medication), demographics, smoking status, occupational exposures, seasonality, covarying pollutants, time spent outdoors, and exercise. This also assumes that the use of health services is appropriate for the severity of the health outcome (e.g., an admission to the hospital for a respiratory problem indicates the severity of the problem and is the "correct" response).

2.19 The categories of health effects presented in this chapter are not exhaustive, since quantitative evidence is not available for every health effect suspected of being associated with air pollution. Air pollution has also been associated with non-health effects including materials damage, soiling, and visibility degradation. These exclusions suggest that the results of this analysis are likely to underestimate the damages resulting from exposure to air pollution.

Health Improvement From Pollution Abatement

2.20 The change in health effects expected to occur in Pulau Pinang, Perak, Kuala Lumpur, and Johor by reducing ambient concentrations of particulate was estimated; this change was estimated for two levels of particulate:

- The recommended Malaysian guideline --90 ug/m3; and
- The lower end of the WHO guideline --60 ug/m3.

2.21 According to Table 2.3, reducing ambient concentrations of particulate to the recommended Malaysian guideline could prevent 1,300 deaths, 23,200 admissions to respiratory hospitals, 54,000 emergency room visits, 13,284,300 days of restricted activity, 381,900 cases of bronchitis in children, and 3,943,900 asthma attacks.

Table 2.3: Estimated Number of Health Effects Avoided by Reducing TSP Pollution

HEALTH EFFECT	*NUMBER OF HEALTH EFFECTS AVOIDED BY REDUCING TSP TO:*	
	90 ug/m³	60 ug/m³
Mortality	1,300	1,900
Respiratory Hospital Admissions	23,200	33,600
Emergency Room Visits	54,000	78,000
Restricted Activity Days	13,284,300	19,202,200
Bronchitis in Children	381,900	552,100
Asthma Attacks	3,943,900	5,700,700

Note: 90 ug/m³ is the recommended Malaysian guideline; 60 ug/m³ is the lower end of the WHO guideline.

Source: Table 2.1 and Annex 2A.1.

2.22 An analysis of data from the 1986-1987 National Health and Morbidity Survey indicates that asthmatics in Malaysia experienced 22.5 attacks on average over the past 12 months. Since about nine percent of the Malaysian population --about 1.54 million-- suffers from asthma, there are on average 34.6 million asthma attacks per year. Results in Table 2.3 are for the four largest cities of Malaysia, which represent about one third of the total population. The reduction of 3,943,900 asthma attacks per year for a third of the population corresponds to a 30 percent reduction nationwide.

2.23 Ninety percent reduction of ambient lead, which could be accomplished through a ban on leaded gasoline, could reduce the number of health effects due to lead. Calculations presented in Table 2A.3 in the annex show that reducing ambient concentrations of lead by 90 percent in Kuala Lumpur and Selangor could prevent about 36 deaths, 1,141 cases of hypertension, 36 chronic heart diseases. It would also have a substantial beneficial impact on the health of children (estimated as prevention of a loss of almost one million IQ points).

Economic Value of Health Improvements

2.24 To provide a sense of the magnitude of the economic value associated with the assumed changes in air pollution, dollar values were placed on the health benefits. Ideally, the dollar values reflect the full impact to the affected individuals. This would include both out-of-pocket expenses, such as medical costs and lost income (referred to as "cost of illness"), and less tangible effects on well-being, such as pain and discomfort and restrictions in non-work activities. In welfare economics, such a dollar measure is defined as the dollar amount that would cause the affected individual to be indifferent between experiencing the health effect or having a loss in income equal to that dollar amount. This is referred to as the maximum willingness to pay (WTP) to prevent or eliminate the health effect.

2.25 The economic value of health benefits associated with reductions in TSP and lead pollution is shown in Tables 2.4 and 2.5. Annex 2A.2 provides details on the cost inputs used to calculate this economic value. The costs of pain and suffering, inconvenience, commuting, and losses in leisure and other impacts to the individual and family well-being were not estimated.

2.26 Table 2.4 indicates that bringing concentrations of TSP down to the recommended Malaysian guideline could reduce costs by RM1.4 billion. Bringing down TSP concentrations to 60 ug/m3 --the lower end of the WHO guideline-- could avoid a total of RM2 billion. Table 2.5 shows that health costs amounting to 1.1 billion could be avoided by reducing lead concentrations by 90 percent. Taken together, the monetized value of health benefits of reducing lead and TSP pollution is substantial and ranges from RM2.5 billion to RM3.2 billion. As a comparison, total government expenditure on health in 1992 was RM2.1 billion.

Table 2.4: Estimated Economic Value of Health Benefits from Reducing TSP Pollution

Health Effect	*Health Effect Value (RM Per Case)*	*Benefit (RM million) from reducing TSP to:*	
		90ug/m³	*60ug/m³*
Mortality	768,750	1,023	1,461
Respiratory Hospital Admissions	3,961	92	133
Emergency Room Visits	391	21	30
Restricted Activity Days	10	133	192
Bronchitis in Children	73.8	28	41
Asthma Attack	25.6	101	146
TOTAL	-	1,398	2,003

Note: 90 ug/m³ is the recommended Malaysian guideline; 60 ug/m³ is the lower end of the WHO guideline, as explained in Section 1.1.

Source: Annex 2.2 and Table 2.3.

Table 2.5: Estimated Economic Value of Health Benefits From Reducing Lead Pollution

Health Effect	*Health Effect Value (RM Per Case)*	*Benefit (RM million) from 90% reduction*
Mortality	768,750	28
Hypertension	56.4	0.1
Chronic Heart Disease	12,556	0.5
IQ Loss (points)	1,176	1,064
TOTAL	-	1,092.6

Note: A 90 percent reduction of ambient lead could be accomplished through a ban on leaded gasoline.

Source: Annex 2.2 and Table 2.4.

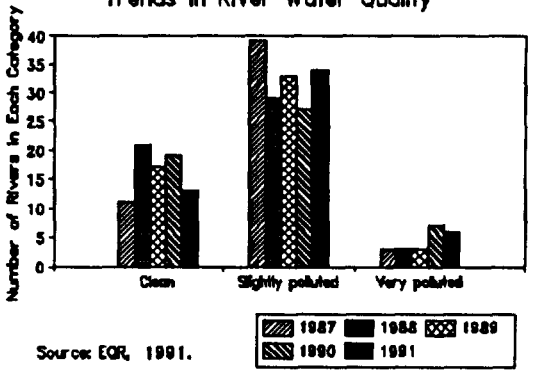
B. Health Implications of Water Pollution

2.27 This section attempts to estimate the health benefits --or costs avoided-- of reducing diarrhoeal diseases by improving water supply and sanitation in Malaysia.

Current Concentrations and Trends

2.28 In 1991, the water quality, in general, was worse than in 1990. Monitoring of 87 rivers in Peninsular Malaysia shows six very polluted rivers, 44 rivers slightly polluted, and 37 rivers clean. Most rivers in Sabah and Sarawak are clean. The deterioration of water quality follows a five-year trend (1986-1991) reflected in Figure 2.2. which shows the number of rivers in Peninsular Malaysia in each of three categories: clean, slightly polluted, and very polluted. The trend indicates that the number of rivers in the slightly polluted and very polluted categories tend to increase while the number of rivers in the clean category tend to decrease.

Figure 2.2
Trends In River Water Quality



Source: EQR, 1991.

2.29 The water quality assessment is based on several indicators:

- Ammoniacal nitrogen for pollution from animal wastes and sewage.
- Suspended Solids for soil erosion and sedimentation.
- Biochemical oxygen demand for organic pollution, mostly from industrial and domestic effluents.

Other parameters such as heavy metals and nutrients are also measured and reported in the 1991 Environmental Quality Report.

2.30 The best indicator for sewage contamination from domestic and animal wastes is E. Coli. Although DOE said that E. Coli was also measured, it is only reported for the coastal water and river estuary monitoring stations.[3/] The figures in the report indicate that E.Coli exceeds its interim standard more than 42 percent of the time. Oil and grease and suspended solids also exceed their interim standards 96 and 67 percent of the time, respectively.

2.31 Drinking water quality is not yet adequate. Surveillance of drinking water quality is an important public health activity performed by the Ministry of Health (MOH). Continuous and effective surveillance of drinking water quality can prevent or reduce potential disease outbreak related to poor water quality due to inadequacies in the operation and maintenance of water treatment plants. MOH measures E.Coli in the drinking water at the intake point. Drinking water quality is slightly improving but does not yet meet the national standard. For example, three percent of the samples taken in 1989 contained faecal coliform -- it should be zero percent according to the National Standards on Drinking Water Quality that are based on World Health Organization guidelines (MOH, 1989).

Health Implications

2.32 Communicable diseases associated with poor sanitation, insanitary water supply and excreta disposal, and poor personal hygiene continue to be important causes of morbidity in Malaysia. Domestic sewage is responsible for the large incidence of water-borne diseases such as cholera, dysentery, and typhoid. Uncontrolled garbage disposal is also responsible for vector borne diseases such as the Dengue Fever. For example, Aedes (a form of mosquito) have been spreading the Dengue Fever by breeding in used tires, septic tanks, and cocoa-pods (MOH, 1989).

2.33 Two studies have compared incidences of water-borne diseases with the quality of water supply:

- The 1986-1987 National Health and Morbidity Survey (MOH, 1988) correlated the water supply status with the acute illness rate.

[3/] An analysis of 1991 E.Coli data for all rivers provided by DOE shows that only 477 records out of 606 records --almost 80 percent-- are above the 10 MPN/100ml standard for Class I rivers.

Water supply was graded from 1 --best-- to 4 --worst-- on six aspects (safety, sufficiency, source type, continuity, accessibility, and percent of households served). As shown in Table 2.6, the illness rate in rural areas with good water supply --Grade 1-- was significantly lower than the corresponding rates in rural areas with unsatisfactory water --Grades 2, 3, and 4. Rural areas with good water supply had rates similar to those in urban areas.

- MOH's Institute of Medical Research (IMR) was established in 1990 to conduct biomedical research, gather information, and increase with respect to environmental factors and their impact on human health including environmental impact studies in relation to national development (MOH, 1989). IMR studied the relationship between water quality and diarrhoeal diseases in Kelantan. IMR collected 310 samples from 12 villages, with 93 percent of water samples from well water and the remainder from JKR piped water supply. The average coliform count per sample across all villages was 6,187, with a range of 0 to 100,000. This high coliform count may have caused the 51 diarrhoeal diseases that were reported between July and November in a group of 2,566 children seven years and below.

Table 2.6: Water Supply and Illness Rates

Water Supply Status	*Number in Sample*	*Illness Rate*[4]
Grade 1	11,547	5.8
Grade 2	4,299	7.2
Grade 3	5,691	6.9
Grade 4	5,311	8.5
Survey not done -- urban areas under Local Authorities	26,577	6.0
Unknown	10,502	6.6

Source: MOH, 1988.

[4] The illness rate is the percentage of people who experienced an illness in the two weeks preceding the survey.

2.34 There is also anecdotal evidence on the causes of outbreaks of water-borne diseases in some of the cities of Malaysia:

- The 1987 outbreak of typhoid in Penang is another example of the impact of water pollution on health (MOH, 1987). Although the number of typhoid cases in Penang were down to less than 100 until 1985, there were 321 cases in 1986 and more than 649 cases in 1987. Students accounted for the largest number of cases followed by unemployed people and by housewives. A total of 1,209 food and water samples were analyzed. Seven samples were contaminated with Salmonella organisms. Although no definitive source could be traced during this outbreak, several links to contaminated food and water could be established. MOH recommended replacing all bucket latrines by sanitary latrines, treating raw sewage, and training food handlers regarding basic standards of hygiene.

- In the early eighties, there were two outbreaks of gastro-enteritis in Seramban, a city with no proper sewerage system. Nearly a third of Seramban tap water during the dry spells came from domestic sewage.

2.35 Diarrhoeal diseases were still prevalent in 1989 and continued to constitute a public health problem. All races and ages were affected, particularly children, those with poor socio-economic status and those living in areas lacking in environmental sanitation and other basic health amenities. The diseases in order of frequency of occurrence were viral hepatitis, food poisoning, typhoid, and cholera. The five-year (1984-1988) trend is not reassuring. For example, the number of cases of cholera rose from 68 in 1985 to 402 in 1989, as shown in Table 2.7. Other diseases seem to remain stable. These numbers probably understate disease incidence since they reflect those that actually used the public health care system. It is quite likely that many more cases were treated in private clinics and are unrecorded. For example, Table 2.6 shows that nearly 6 percent of those interviewed in areas with good water quality report water related illness. This is considerably larger than the numbers reported in table 2.7.

Reductions in Health Effects and Economic Value of Health Benefits

2.36 In order to assess the economic benefits of reduced water borne diseases, two kinds of information is needed: the reduction in illness associated with a given improvement in water quality and the number of base illness cases. Unfortunately, the data in Malaysia on both of these aspects are inadequate, so that the health benefits of clean drinking water cannot be estimated with any precision.

2.37 The international evidence on health benefits of clean water, however, is unambiguous. A review of 144 cross-country studies carried out by USAID concludes that improvements in water supply and sanitation reduce diarrhoeal diseases are large with a median reduction of 22 percent for diarrhea (Esrey, 1990). Clearly, the improvement is greater the lower the level from where a

Table 2.7: Reported Incidence of Five Diarrhoeal Diseases by Year

Disease	*Year*				
	1985	*1986*	*1987*	*1988*	*1989*
Cholera					
Cases	68	54	584	753	402
Deaths	4	2	9	17	14
Typhoid					
Cases	2,358	2,845	2,962	1,731	1,613
Deaths	17	23	12	4	1
Dysentery					
Cases	785	846	955	774	640
Deaths	3	1	1	0	0
Food Poisoning					
Cases	1,418	1,877	2,272	1,643	1,782
Deaths	3	11	10	25	2
Viral Hepatitis					
Cases	3,210	7,261	4,529	4,533	2,322
Deaths	0	3	4	3	4
TOTAL CASES	7,839	12,883	11,302	9,434	6,759
TOTAL DEATHS	27	40	36	49	21

Source: MOH, 1989

country starts. Given that coverage of urban clean drinking water in Malaysia is good (see Chapter V), using the estimated median contribution of improvements in water supply to reduction in diarrhoeal diseases would over-estimate the health benefits.

2.38 The evidence on the incidence on diarrhoeal diseases in Malaysia collected by the Ministry of Health (Table 2.7) is also imprecise. In 1989, the number of cases of these diseases was 6,759 and 21 deaths were reported to have occurred. However, as argued above, these numbers should be interpreted carefully. It is quite likely that coverage is incomplete and many cases go unreported. Thus, the incidence of disease may have been under-estimated, particularly in view of the high incidence of overall disease (almost 6 percent in areas with best quality of water) found in the Morbidity survey (Table 2.6).

2.39 Correcting for the over-estimation in the first piece of information and under-estimation in the other would require information that is not available. Assuming that the morbidity survey reported disease incidence of 6 percent is closer to the true number and that at Malaysia's income and service level, the health improvement impact of clean water is in the range of 5 to 10 percent, the range of reduction in sickness incidence is calculated to be between 25,000 and 50,000 cases. Using the costs in Annex 2A.2 and assuming that each case requires 10 days in a hospital, 20 days of restricted activity, and a US$300 vaccine (Jamison, 1990), the benefit per case avoided is RM1,320. Thus 100 percent coverage of clean drinking water in Malaysia would result in health benefits of between RM 34-68 million.

C. Health Implications of Hazardous Waste Pollution

2.40 Hazardous wastes are regulated under the 1989 Scheduled wastes regulations. The 1989 Scheduled wastes regulations have set out the requirements for storing, collecting, packaging, labeling, treating, and disposing of scheduled wastes. Under these regulations, generators of any scheduled wastes are mandated to notify DOE of their generation, treatment, and disposal activities. Although discharges of toxic industrial wastewater into surface water drains and combined disposal with municipal wastes still occur, the regulations have to a certain extent succeeded in controlling indiscriminate disposal of such wastes (DOE, 1992. Further details on hazardous waste are presented in the next Chapter).

2.41 Due to the absence of scheduled wastes treatment facilities in Malaysia, industries have to store, pretreat (e.g., precipitation and filter press), or export their wastes. Some plants even resort to illegal dumping of wastes. Such incidences would increase if no solution is provided. DOE is trying to improve current hazardous waste management practices by establishing an integrated treatment and disposal facility.

Health Implications

2.42 Toxic chemicals in hazardous wastes threaten human health and the environment. All environmental media are affected. The contamination of ground water by hazardous constituents that leach out of land disposal or storage units and migrate through soil to underground aquifers represents an exposure pathway with the potential for human health risk and environmental degradation. Ingestion of contaminated surface water and inhalation of contaminated air also affect human health. Hazardous wastes contain chemicals that are carcinogens, whose effects only occur after a long period of exposure. Other chemicals may not cause cancer but may lead to a variety of organ disorders. For example, excessive exposure to phenols can affect the heart, lung, kidneys, and liver; excessive exposure to cyanide is associated with thyroid and neurological disorders. Therefore, hazardous waste pollution has important health implications.

2.43 Current hazardous waste management practices in Malaysia threaten public health. Improper storage or "open dumping" may lead to releases of toxic and hazardous substances to the environment in an uncontrolled manner. These releases contaminate air and water, and threaten public health due to long term exposure to pollutants. Open dumping can also contaminate ground water and expose nearby residents to high levels of toxic substances. In addition, improper storage can cause explosions, toxic gas formations, fires, etc. The public near such facilities is at a high level of risk. Toxic substances also damage ecosystems. Low level releases of toxic substances over extended periods of time have carcinogenic, mutagenic, and teratogenic effects on terrestrial, aquatic, and birdlife species. Bioaccumulation through the food chain can amplify problems.

Health Improvements From Abatement

2.44 The DOE is establishing standards for treating scheduled wastes and disposing of treatment residuals in a safe manner. These standards will apply to the future integrated treatment and disposal facility. These standards should also promote waste minimization to reduce the quantity of waste generated and improve environmental quality. Some wastes, however, cannot be minimized and need to be handled in an environmentally acceptable manner, otherwise they will hinder industrial growth. A cost-effective implementation of the 1989 regulations is critical to industrial growth and national development.

2.45 The economic benefits of health improvements due to proper management of hazardous waste are even more imprecise than those for water, because data on toxic waste accumulation in Malaysia and human exposure are very poor. Some extrapolations, however, from the U.S. experience. In the mid-eighties, the U.S. Environmental Protection Agency (EPA) developed a series of regulations to restrict the land disposal of hazardous wastes. Hazardous wastes must be treated to minimize the mobility or toxicity of hazardous constituents before being placed or disposed of on the land. These land disposal restrictions have resulted in treatment standards for various types of wastes, similar to the standards that are now being established by DOE. EPA has examined the health benefits associated with these hazardous waste regulations (EPA, 1990). Most of the cancer risk reduction can be attributed to iron and steel wastes, petroleum wastes, and metal-bearing sludges. These wastes contain high concentrations of arsenic, benzene, cadmium, chromium, and lead. Cancer cases are avoided by reducing human exposure to arsenic in ground water and benzene in air. The EPA study also reports that a large percentage of non-cancer cases could be avoided by treating a highly concentrated chromium waste that leaches to ground water supplying a public drinking water well that serves a populous Northeastern community.

2.46 The EPA has estimated that restricting the amount of hazardous waste for land disposal to 336 million gallons each year--about 1.3 million tons--could prevent roughly 800 cancer cases over a 70-year period and about 8,600 cases of non-cancer illness annually (EPA, 1990). Extrapolating EPA findings to Malaysia are fraught with difficulties due to differences in income, hydrogeological settings and concentrations of population exposed. Moreover, the amount of hazardous waste generated in Malaysia is not known with any precision.

Thus a firm data base would be the first priority in estimating the health hazards of toxic waste and the benefits associated with treatment and safe disposal (more on this in Chapter III).

D. Summary of Recommendations

2.47 Health implications of pollution are key to conducting a cost-benefit analysis of abatement policies and implementing cost-effective measures. This requires improving the knowledge base of the health effects of pollution. To that end, the recommendations made are:

(i) Additional Air and Water Monitoring. It would be useful to analyze and report pollutants such as ozone, carbon monoxide, nitrogen oxides, and sulfur dioxides as often as particulate and lead. Monitoring particulate matter below 10 microns would provide a better indicator of the danger to human health. Finally, E.Coli could be analyzed and reported for all rivers to measure bacteriological water quality. It is useful to report trends, even when they reflect increased environmental pollution. A list of measures to improve the trends over the next 12 months could also be developed.

(ii) Collecting Health Statistics from Private Doctors and Clinics. Health statistics compiled by MOH cover only public hospitals. A report on the number of incidence of asthma attacks or bronchitis may provide a better understanding of the link between environmental pollution and health. It would be useful to conduct regular surveys similar to the 1987 Morbidity survey.

(iii) Developing Malaysian-Specific Dose-Response Functions. Malaysian-specific dose-response functions could provide better input to cost-benefit analyses. Incidents such as the Haze provide information that could be used to develop dose-response functions.

(iv) Creating a Toxic Release Inventory. Such inventories would provide annual information on all of the toxic chemicals released by Malaysian factories from all industrial sectors (e.g., palm oil, rubber, steel, petroleum). The inventory would quantify releases to environmental media (e.g., air, water, soil) and transfers of wastes to other factories or other countries. The public could access the computerized data from any public library.

(v) Creating an Environmental Health Unit. Such a unit could investigate health complaints from environmental problems. Although the unit would not have any enforcement power, it could enter plants or places suspected to cause health problems and thus improve the information base for remedial action.

Annex 2A.1: Dose-Response Functions

1. This annex presents the dose response functions used in this study to quantify the reduction in human health effects resulting from reducing ambient concentrations of air pollutants. The dose-response functions used in this study had been used in the Jakarta study (Ostro, 1992). In the absence of Indonesian specific parameters, some U.S. parameters had been used. When Malaysian inputs were available, they replaced the U.S. or Indonesian parameters, as follows:

- The mortality rate in Malaysia is 0.0047, instead of 0.007 in Indonesia.
- The proportion of population below age 14 in Malaysia is 37.1; the proportion of population below age 18 in the United States is 17.07 percent --there are no statistics on the population below age 18 in Malaysia.
- About 9 percent of the population in Malaysia is afflicted with asthma, as opposed to five percent in the United States.

2. Tables 2A.1 and 2A.2 summarize these functions for TSP and lead, respectively. For each health effect, Table 2A.1 presents a central estimate of the estimated effect. The central estimate is typically selected from the middle of the range reported in a given study from the literature, or is based on the most recent study using the most reliable estimation methods available.

Table 2A.1: TSP Dose-Response Functions

Health Effect	*Central Change in Health Effect/Change in TSP*
Mortality	$3.2\ 10^{-6}$
Respiratory Hospital Admissions	$5.6\ 10^{-5}$
Emergency Room Visits	$1.3\ 10^{-4}$
Restricted Activity Days	$3.2\ 10^{-2}$
Bronchitis in Children	$9.2\ 10^{-4}$
Asthma Attacks per asthmatic	$9.5\ 10^{-3}$

Note: If TSP concentrations were to increase by one ug/m3, the number of deaths would increase by $3.2\ 10^{-6}$.

Source: Ostro, 1992, as adjusted in the Paragraph 1 above.

Table 2A.2: Lead Dose-Response Functions

Health Effect	*Probability (percentage)*
Hypertension	$(1 + \exp-(-2.744 + 0.793\ (\ln 2PbA_1)))^{-1} - (1 + \exp-(-2.744 + 0.793\ (\ln 2PbA_2)))^{-1}$ Where: PbA_1 = initial air lead level (ug/m^3) PbA_2 = new air lead level (ug/m^3)
Chronic Heart Disease[a]	$(1 + \exp-(-4.996 + 0.030365 \times 76))^{-1} - (1 + \exp-(-4.996 + 0.030365 \times (76 - 2.74\ (\ln PbA_1/PbA_2))))^{-1}$ Where: PbA_1 = initial air lead level (ug/m^3) PbA_2 = new air lead level (ug/m^3)
Mortality[a]	$(1 + \exp-(-5.3158 + 0.03516 \times 76))^{-1} - (1 + \exp-(5.3158 + 0.03516 \times (76 - 2.74\ (\ln PbA_1/PbA_2))))^{-1}$ Where: PbA_1 = initial air lead level (ug/m^3) PbA_2 = new air lead level (ug/m^3)
IQ Loss (points)[b]	IQ decrement = 0.975 x change in air lead (ug/m^3)

a/ Probabilities for chronic heart diseases and mortality are 10 and 12-year probabilities, respectively.

b/ The IQ decrement is expressed as lost IQ points, not as a percent probability.

Source: Ostro, 1992.

Table 2A.3: Estimated Number of Health Effects Avoided by Reducing Lead Pollution

HEALTH EFFECT	*NUMBER OF HEALTH EFFECTS AVOIDED BY 90% REDUCTION*
Mortality	36
Hypertension	1,141
Chronic Heart Disease	36
IQ Loss (points)	904,399

Note: A 90 percent reduction of ambient lead could be accomplished through a ban on leaded gasoline.

Source: Table 2.2 in the main text and Annex 2A.1.

Annex 2A.2: Value of Health Effects

1. This annex explains how the costs in the Jakarta study (Ostro, 1992) were adjusted for this study.

2. Cost estimates in this annex are expressed in Malaysian Ringgits. Any cost estimate expressed in U.S. dollars in the Jakarta study has been converted to Malaysian Ringgits using an exchange rate of US$1 = RM2.5 and has been weighted by the relative GNP per capita of Indonesia versus Malaysia (4.1 according to Table 1 of the 1992 World Bank report on Development and the Environment (World Bank, 1992)). Table 1 also shows that the GNP per capita in Malaysia is US$2,320, which is equivalent to RM5,800. The daily GNP per capita is RM21, assuming an average of 275 working days.

Mortality

3. The Jakarta study estimates a benefit of US$75,000 per death avoided. After converting this estimate in Ringgits and adjusting by the GNP ratio, this benefit is equivalent to RM768,750.

Respiratory Hospital Admissions

4. The average cost per hospital inpatient admission in Malaysia is RM370 (EPU, 1989). The Jakarta study indicates that the average respiratory hospital visit lasts 10.13 days. In addition, each day lost at the hospital is valued at the daily GNP of RM21. Therefore, each respiratory hospital admission costs RM3,961.

Emergency Room Visits

5. The dollar value for an emergency room visit is based on the value of time lost (assumed to be one day) and the average cost of a visit to an emergency room assumed to equal the cost of a hospital admission. The combined total is RM391.

Restricted Activity Days

6. Using the assumptions in the Jakarta study, we estimate that 20 percent of the restrictions in activity result in work loss --valued at RM21-- and that the remaining 80 percent can be valued at one third --RM7. This generates an estimate of RM10 for a restricted activity day.

Bronchitis in Children

7. The Jakarta study estimates the value of bronchitis to be US$5.25. After converting this estimate in Ringgits and adjusting by the GNP ratio, this value is equivalent to RM53.8. We also assumed that each episode of bronchitis would cause two restrictions in activity by a parent for day care. Thus, the total cost for this illness is RM73.8.

Asthma Attack

8. The Jakarta study estimates the value of an asthma attack to be US$2.5. After converting this estimate in Ringgits and adjusting by the GNP ratio, this value is equivalent to RM25.6.

Hypertension

9. A case of hypertension is valued at US$5.5 in the Jakarta study. After converting this estimate in Ringgits and adjusting by the GNP ratio, this is equivalent to RM56.4.

Chronic Heart Disease

10. The Jakarta study estimates the value of myocardial infarction, including medical expenses and lost earnings to be US$1,225. After converting this estimate in Ringgits and adjusting by the GNP ratio, this is equivalent to RM12,556.

IQ Loss

11. A one point IQ loss in children results in lost lifetime earnings of US$114.7 in the Jakarta study. After converting this estimate in Ringgits and adjusting by the GNP ratio, this is equivalent to RM1,176.

III. INDUSTRIAL POLLUTION

Introduction

3.1 Malaysia's manufacturing output increased eightfold between 1970-92. In 1992, it stood at RM 43.1 billion and accounted for 29.3 percentage of Malaysia's GDP, 44.1 percent of exports and 20.5 percent of employment (Table 3.1). While this has brought skilled urban jobs and higher incomes, it has also contributed to the problem of industrial pollution. Three principal forms of industrial pollution in Malaysia are: (i) Suspended particulate discharge that cause air pollution; (ii) BOD (Biological Oxygen Demand) discharge that causes water pollution and (iii) Toxicity discharge that affects all elements. Trends in manufacturing output and in the intensity of each of the discharges (Figs 3.1a to Fig 3.1d) show that particulate discharge increased in the initial phase of industrial growth but is now declining, BOD has declined consistently while toxic waste discharge has increased in recent years[1/].

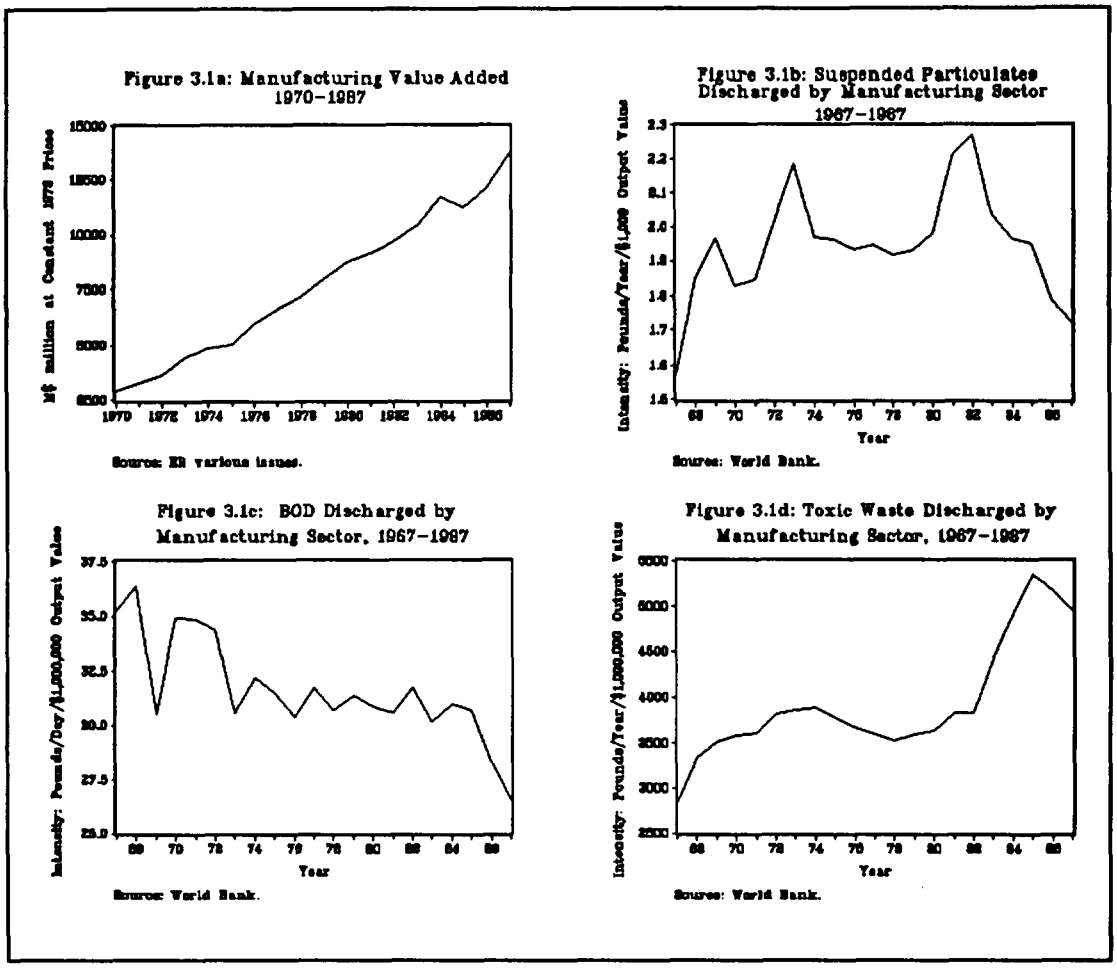
Table 3.1: Manufacturing Sector Growth and Importance

Manufacturing sector share in	*1970*	*1980*	*1992*
GDP	11.9	20.6	29.3
Exports	12.0	22.4	67.5
Employment	9.2	15.6	20.5

Source: Economic Reports, various years.

3.2 This chapter, in part A, identifies the major industrial sources of air and water pollution and presents a profile of the generators of hazardous waste. Part B discuses abatement policy; abatement costs are estimated, the current practice is evaluated and a cost-effective market-based strategy is outlined. Looking to the future, Malaysia's principal industrial pollution problem will be hazardous waste. Additional considerations in designing policy for industrial hazardous waste are discussed in Part C.

[1/] Note that changing intensities reflect changing structure of the economy rather than changing technology, so that more toxic waste generation means that more of the industrial output is produced by toxic waste generating firms and not that the technology in any one firm generates more hazardous waste. These results are based on the World Bank's ongoing Work, "Industrial Pollution Projection System".



A. The Industrial Pollution Profile

3.3 Identifying the principal sources of industrial pollution is necessary for designing abatement policy. Unfortunately that is not straightforward. It requires reconciling three different types of information on pollution load, number of polluters and pollution intensities of polluters. The first two are based on data collected by the DOE in Malaysia while the last, though the most consistent across different types of pollution, is based on projecting US intensities to Malaysian industrial structure.[2/]

[2/] See Paul Martin, Mala Mettige, David Wheeler and Ralph Stagren, (1991) "The Industrial Pollution Projection System: Concept, Initial Development and Critical Assessment" (Mimeo, World Bank).

Industrial Sources of Air and Water Pollution

3.4 The DOE reports that 3057 point source of air pollution in Malaysia spewed out 8675.9 metric tones of pollutants (particulates, SOx, NOx, CO, and HC). The top eight polluting industries are ranked in column 1 of Table 3.2 by share of pollution load. For comparison, the top eight polluting industries in terms of intensity of pollution are reported in column 2 of Table 3.2. Even though the ranking is different for the two measures, both rank woodbased, non-metal, food, iron and steel among the major sources of pollution.

Table 3.2: Most Important Industrial Sources of Air Pollution

Ranking by Pollution Load [1]: (shares of total loads)		*Ranking by Pollution Intensity:* (IPPS Method)[2]	
Woodbased	28.7	Non-metal Products	25.1
Palm Oil	15.8	Petroleum & Coal	11.8
Food	8.3	Wood Products	10.3
Non-metal	8.0	Non-ferrous Metals	9.1
Textile	6.3	Pulp, paper	5.3
Rubber Products	6.0	Other Paper	4.7
Iron & Steel	5.7	Iron & Steel	3.5
Chemicals	5.6	Glass & Products	3.1

Source: EQR, 1991 for pollution loads, World Bank for pollution intensities.

Notes:
1. Load measured in metric tones of various pollutants;
2. Industrial Pollution Projection System whereby intensity is measured in pounds per year per $1,000 output value. In this table intensities are presented only for suspended particulates. This is an international average applied to the Malaysian industrial structure.

3.5 The DOE no longer gives information on the most important polluters of water by pollution load. Instead, information is presented according to the number of polluters. Accordingly, Table 3.3 presents the ranking by number of polluters to contrast it with the ranking by the IPPS method. Again, even though the two methods rank the top seven polluters differently, several of the top polluters are the same industries.

Table 3.3: Most Important Industrial Sources of Water Pollution

Ranking by Pollution Source Share:		*Ranking by Pollution Intensity 1/:*	
Food & Beverage	40.5	Other Chemical Products	361.9
Rubber Products	14.1	Pulp, paper	113.6
Chemicals	11.8	Food Products	78.9
Palm Oil	11.6	Non-Ferrous Metals	52.4
Textile & Leather	9.0	Beverages	26.3
Raw Natural Rubber	8.6	Basic Ind. Chemicals	5.5
Paper	4.4	Metal Products	3.3

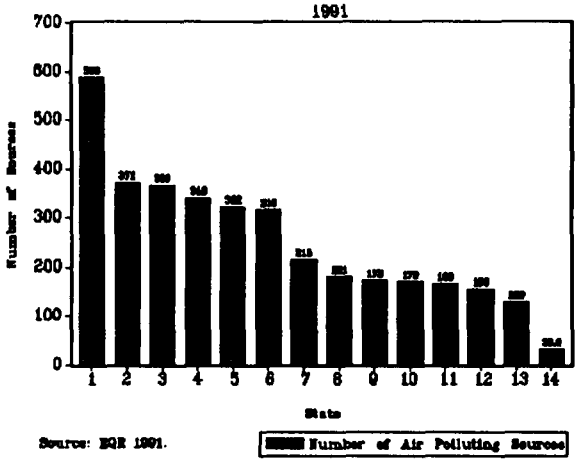
Sources: EQR, 1991 for pollution source share; World Bank for pollution intensities.

Notes: 1. Intensity measured in pounds per day per $1,000,000 output value only for BOD.

3.6 The location concentration of industrial sources of air and water polluters is presented in Figure 3.2. The five states with the largest number of air polluters (Figure 3.2a) are Selangor, Perak, Federal Territory (KL), Pulau Pinang and Johor. The five states with the largest concentration of water polluters (Fig 3.2b) are Selangor, Johor, Pulau Pinang, Perak and Kedah.

1. Selangor
2. Perak
3. Federal Territory (KL)
4. Pulau Pinang
5. Johor
6. Pahang
7. Kedah
8. Sarawak
9. Trengganu
10. Melaka
11. Negeri Sembilan
12. Sabah
13. Kelantan
14. Perlis

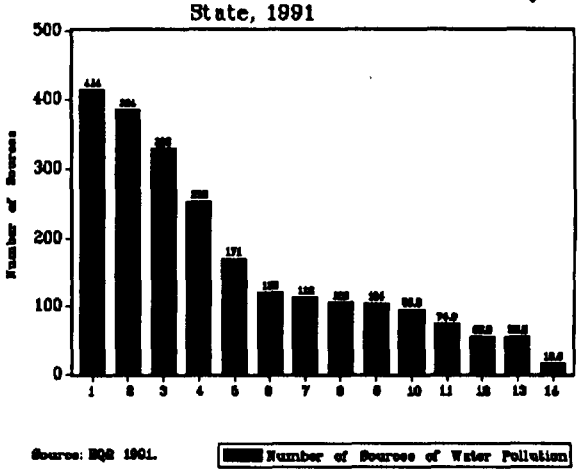
Figure 3.2a: Number of Significant Stationary Air Polluting Sources by State 1991



Source: EQR 1991.

1. Selangor
2. Johor
3. Pulau Pinang
4. Perak
5. Kedah
6. Terengganu
7. Pahang
8. Wilayah Persekutuan (K.L.)
9. Sabah
10. Negeri Sembilan
11. Melaka
12. Kelantan
13. Sarawak
14. Perlis

Figure 3.2b: Number of Significant Industrial Sources of Water Pollution by State, 1991



Source: EQR 1991.

Major Toxic Waste Producers

3.7 Information on toxic and hazardous waste is sketchy especially about how much of it there is and what kind. According to the Department of Environment (DOE)[3/], Malaysian industry produced an estimated 380,000 cubic meters, or approximately 100,000 tons, of hazardous wastes in the mid 1980s (Table 3.4). These figures, however, can be considered as the roughest estimate

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[3/] The U.S. engineering firm, Dames and Moor estimated the figures based on the initial survey by the DOE in 1984.

because the sample size is small and the data are old. Manufacturing output doubled in real value from 1986 to 1991, and the composition of hazardous wastes output may have changed as well.

3.8 The most important sources of hazardous waste by industry are ranked in Table 3.5 both by the pollution loads estimated in the DOE study and by pollution intensities estimated using the IPPS method. The two methods give quite different rankings and it is difficult to say categorically which of the two is more reliable: the DOE ranking is based on old data while the IPPS method use international averages and not Malaysia specific emissions. In the discussion on hazardous waste in the text, the DOE ranking will be used since that is based on Malaysian data.

Table 3.4: Malaysia: Scheduled Waste Generation, by Category of Waste, 1984

Waste Category	*Quantity*	
	(square meter/year)	Percentage (%)
Acids (poss. with heavy metals)	83142	22.0
Sludge (with heavy metals)	56384	15.0
Sludge, mineral	47495	12.6
Asbestos	34284	9.1
Paint/dye/ink/pigment (water-based)	29024	7.7
Dusts/slag/clinker/ashes	27489	7.3
Alkalis (poss. with heavy metals)	26764	7.1
Oil and hydrocarbons	19896	5.3
Others	16804	4.5
Photographic wastes	11969	3.2
Rags/paper/plastic (contaminated)	5575	1.4
Paint/dye/pigment (solvent-based)	4980	1.3
Sludge, oil	3764	1.0
Pathogenic/pathological wastes	3476	0.9
Solvents,non-halogenated	2471	0.7
Sludge, paint/dye/ink (water-based)	1467	0.4
Sludge, paint/dye/ink (solvent)	950	0.2
Solvents, halogenated	676	0.2
Resins and glue	464	0.1
Total	377076	100.0
Containers (pieces)	615378	-

Source: Toxic & Hazardous Waste Study, Department of Environment, Malaysia, 1988

Table 3.5: Most Important Industrial Sources of Hazardous Waste

Ranking by Pollution Load1/ (shares in total loads)		*Ranking by Pollution Intensity 2/*	
Metal Finishing	28.0	Agr. Chemicals	52260
Textile	14.5	Other Ind. Chemicals	52260
Industrial Gas	14.0	Basic Ind. Chemicals	32255
Foundry/Metal Works	9.5	Leather & Products	15381
Asbestos	8.0	Synthetic Resins	14003
Film Processing	2.5	Plastic Prod. n.e.c.	9335
Packaging/Printing	2.0	Non-Ferrous Metals	9334
Automotive Workshops	2.0	Other Paper Prod.	8742

Source: Toxic & Hazardous Waste Study, Department of Environment, Malaysia, 1988 for pollution loads, World Bank for pollution intensities.

Notes: 1. Load measured in tones of hazardous wastes;
2. Intensity measured in pounds per year per $1,000,000 output value.

3.9 More recent estimates by the DOE are that the country generated 337,000 tons of scheduled hazardous waste in 1992, and that it will produce 470,000 tons by 2000. Another study projected annual growth rates of scheduled hazardous wastes between 1992 and 1997 of 10% in electrical appliance, glass, plastic, and resin industries; 9% in vehicle component industries; 8% in lacquer and metalwork, packing and printing, varnish, ink, pigment, and lacquer industries; 7% in vehicle assembly and detergent, soap, and toiletry industries; and 6% in the film processing, lubricating oil recycling, paper, pesticide, rubber products, and textile industries.[4]

3.10 To conclude, the existing Malaysian data base suggests that the nine major industrial polluters are metal finishing, electrical & electronics, textiles, food processing, chemicals, palm oil, rubber, woodbased and iron & steel manufacturing units. Most of these are concentrated in Selangor, Pulau Pinang, Johor, Perak and Kuala Lumpur federal territory. Although the DOE data base and IPPS method differ in details, they are broadly in agreement on the principal sources of industrial pollution. Both these data bases will be used in the policy analysis of Parts B and C.

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[4] I Kruger and others, Environmental Impact Assessment Report on The Centralized Hazardous Waste Treatment Center(Kuala Lumpur: 1992).

B. Industrial Pollution Abatement

The Technical Options

3.11 Unchecked emissions by industry into air, water and in the form of toxic waste pose a serious risk to humans as well as to plant life. There are numerous examples from developed and developing countries (Love Canal in the U.S., acid rain in Eastern Europe and Canada, mercury poisoning in Japan, to name a few) that clearly document the risks. Chapter II estimated the health risk and the associated costs of industrial pollution in Malaysia. These risks underscore the urgency of taking remedial action.

3.12 The technical options for the polluting industry in Malaysia are given in Table 3.6, which offers a rich menu ranging from streamlining the production process for improving efficiency to installing new equipment to reduce end-of-the-pipeline emissions. Some of the options involve adopting technologies already in use in developed countries and may not be very expensive. Others may be costly and, given the widespread view that additional costs would harm industry competitiveness, there is no guarantee that industry will voluntarily install abatement equipment. Thus policy makers need guidance regarding costs and industry structure in order to design cost-effective regulations for pollution abatement. The next section presents evidence on costs to the industry, which need to be kept in view in designing cost-effective pollution strategy.

Table 3.6: Selected Environmental Impacts in the Malaysian Industry

Nature of Impact	*Source of Impact*	*Direct Technical Alternatives*
Water Pollution	Food Industry Palm Oil Mills Rubber Industry Pulp and Paper Mills Textile Industry Chemical/Petrochemical	(a) Enhanced industrial efficiency (b) Waste minimization/clean technology(including recycling and reuse); (c) Waste treatment
Toxic and Hazardous Waste	Metal Finishing Electroplating Electronics/Semiconductors Industrial Gas Production	(d) On-site waste water treatment (precipitation, sedimentation, filtration) (e) Central treatment facility for residual sludge (including incineration
Acid//Alkali Wastes	Electronics Metal Finishing Textiles	On-site neutralization
Solvent Wastes	Electronics Metal Finishing	(f) Waste minimization (recovery, substitution); (g) Waste treatment
Air Pollution		
Particulate Emissions	Cement Plants Palm Oil Mills	(h) Emission Control
Gas Emissions (hydrocarbons boiler stack gases)	Iron and Steel Mills Oil Refineries Chemical Plants	(i) Electrostatic Precipitators (j) Improved Operating Practice

The Cost of Abatement

3.13 Evidence from developed countries shows that the cost of industrial pollution control is not very high. Following public outcry, Japan implemented a very successful program of pollution abatement in the 1970's. The average annual abatement investment for the manufacturing sector was 8.8 percent of total annual investment. Furthermore, abatement rise initially and then fall. In Japan the peak was reached in 1977 when abatement investment reached 17.7 percent of the annual manufacturing investment (Fig. 3.3).

3.14 Once the major pollution problems are solved, costs tend to stabilize at similar levels across different countries, at around 4 percent of the total manufacturing investments. Table 3.7 shows this for Japan and the U.S for specific sectors as well as for the overall manufacturing sector. However, abatement costs are an even smaller share of output value; in the U.S,, for example, these range from 0.2 to a maximum of 1.3 percent of the value of output.

Figure 3.3: Abatement Cost Trends

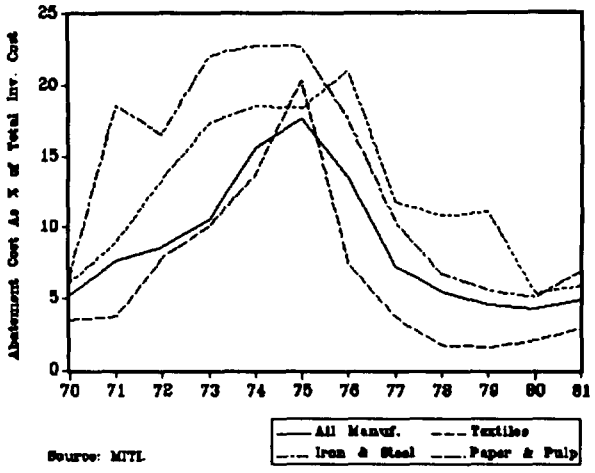

Table 3.7: Comparative U.S.-Japan Pollution Abatement Costs

	Percentage of total investment		*Percentage of output value*
Selected industries	*Japan*	*U.S.*	*U.S.*
All manufacturing	4.9	4.0	0.5
Paper	7.0	8.0	1.1
Chemicals	6.2	9.0	1.3
Machinery	1.1	2.0	0.2
Electrical Equipment	0.7	2.0	0.4
Petroleum	4.5	13.0	1.5
Textiles	2.9	1.0	0.3
Primary metals	5.9	7.0	1.3
Fabricated metals	2.2	3.0	0.6

Source: "Equipment Investment Plan in Major Industrial Sectors," Ministry of Trade and Industry, Japan, and the U.S. Bureau of Census, 1990, 1991; cited in WDR 1992.

3.15 Unfortunately abatement cost data are not gathered systematically in Malaysia for all sectors[2]. However, the experience of the palm oil sector is well-documented. A study[3] undertaken by the Palm Oil Research Institute of Malaysia (PORIM) concludes after studying four different treatment systems, that palm oil mill effluent treatment costs are 3 to 6 percent of total mill processing cost, and about 0.7 to 1.4 percent of total cost of palm oil production. Table 3.8 shows the summary of the study's results based on unit treatment cost per ton of palm oil mill effluent (POME). Note that there is considerable variation in unit cost reduction in effluent reduction, which has implications for designing cost-effective abatement policies (discussed in the next section).

3.16 With pollution treatment costs at less than 2 percent of crude palm oil production, it is not surprising that the majority of palm oil mills have installed treatment systems to reduce the payment of effluent charges. However, it is important to note that the various treatment systems explored in the above PORIM study consider only biological treatment options. The cost of physical/chemical treatment systems would be considerably higher.

Table 3.8: Marginal Cost of POME Treatment per Ton of Effluent[1].

System	*Cost (M $)*	
	*Operating Cost**	*Total Annual Cost*
System A: Ponding	0.45-0.50	0.84-0.88
System B: Tank Digestion and Mechanical Aeration	0.50-0.69	1.38-1.66
System C: Integrated Scheme	0.50-0.87	1.64-2.26
System D: Decanter and Ponding	0.31-0.57	0.84-1.27

Note: 1. Fresh Fruit Bunch (FFB) Effluent.

[2] Such data are not collected either by MIDA or the Federation of Malaysia Manufacturers (FMM), which is surprising given the concern expressed by industry regarding high costs of pollution abatement equipment and procedures. The mission was asked to prepare a brief questionnaire by both MIDA and the FMM to include it in their next round of firm level data collection. A copy of the questionnaire is attached in the appendix to this chapter.

[3] Ma, A.N., "Current Status and Future Trends in the Environmental Management of Palm Oil Industry" PORIM, February 1992.

3.17 To sum up, the evidence from both Malaysia and OECD countries is that abatement costs are typically not very large. Depending on the assumptions made, a comprehensive strategy for pollution abatement in Malaysia would cost the industry, in terms of investment in abatement equipment, between 0.9 to 2.2 percent of the annual manufacturing sector value added, which is a mere 0.3 to 0.6 percent of Malaysia's annual GDP (Table 3.9). This is remarkably slightly lower than the cost estimate of 1.1 percent of GDP presented in a study [1] that used actual DOE pollution data and an input-output model to assess the amount of pollution generated by 16 Malaysian industries.

Table 3.9: Estimated Pollution Abatement Costs in Malaysia, 1992

		Assumptions[1]	
	Japan average 1970-81	*Japan, 1981*	*U.S. 1989*
Share of manufacturing value added	2.0	1.1	0.9
Share of manufacturing exports	2.2	1.2	1.0
Share of GDP	0.6	0.3	0.3

Sources: 1. WDR, 1992; 2. Economic report 1992/93, Ministry of Finance, Malaysia.

Note: 1. It is assumed that Malaysian abatement investments are the same share in total annual investment as in Japan average 1970-81 (8.8%), Japan 1981 (4.9%) and the U.S. 1989 (4.0%).

[1] Chan Huan Chiang (1990), "The Environment: Pressures of High Growth". MIER 1990 National Outlook Conference, 5-6 December, Kuala Lumpur, Malaysia.

Designing Pollution Abatement Policy

The Available Options

3.18 The strategy for industrial pollution standards may be designed from a menu of options, such as command and control type interventions, market-based regulations and provision of services by the government. Within each of this options, several direct and indirect instruments are available. A taxonomy of options and instruments is given in Table 3.10. The choice among these would depend on the structure of cost, the structure of industry, the type of pollution and government's ability to attract skilled personnel for monitoring and regulating.

Table 3.10: Taxonomy of Policy to Reduce Pollution

Policies	*Direct Instruments*	*Indirect Instruments*
Market-based incentives	Effluent charges; tradable permits; deposit refund system	Input/output taxes and subsidies; subsidies for substitutes and abatement inputs
Command and control measures	Emission regulations (source-specific, nontransferable quotas)	Regulation of equipment, processes, inputs, and outputs
Government production or expenditure	Regulatory agency expenditures for purification, cleanup, waste disposal, and enforcement	Development of "clean" technologies

Source: Eskeland and Jimenez (1992) World Bank, Research Observer.

The Practice in Malaysia

3.19 The overall legal umbrella for pollution control in Malaysia is provided by an array of legislation (presented in chapter 1). The DOE has set a large number of ambient standards for air and water pollution, which do not appear to be excessively stringent and are similar to those in many East Asian economies (discussed in chapter 1). Ambient standards, however, are only a broad guideline for pollution control. In practice, policy makers work with emissions standards measured as pollution load. For air pollution, emissions standards are measured in tons of pollution load while water pollution standards in Malaysia are given as concentration ratios of effluents. The effluent concentration standards for water in Malaysia (Table 3A.1b in the annex) are within international guidelines in general. For rubber and palm oil industry (which was

the main source of water pollution in the past) the effluent standards although adequate, are not as tough as those in Indonesia (Table 3A.2).

3.20 Standards have to be monitored. Monitoring is expensive and is done selectively. Palm oil and rubber sectors have good coverage with 42 and 33 percent respectively, of the firms being covered. Monitoring is focused on the larger polluters, which takes care of the bulk of emissions in these two sectors. Over 80 percent of the firms in the two sectors are in compliance. The rest of industry is largely self-monitored. A public complaint system exists (811 such complaints were received in 1991, an increase of 24 percent over 1990), which triggers off investigations to determine whether standards are violated. This resulted in 45 prosecutions in 1991.

3.21 Effluent standards specified as concentration ratios require considerable resources for monitoring, since concentration standards can be met through dilution particularly if water is under-priced. Monitoring can be effective if the industry is clearly identified (as in the Palm oil and rubber industry in Malaysia) and point sources are few. For the industry as a whole, however, concentration standards are a very blunt instrument since monitoring on this scale would be prohibitively expensive. The result is that while many countries have tough emissions standards on paper, they are ignored in practice.

3.22 Whereas emissions standards are an end-of-the-pipeline pollution abatement measure, the Environment Impact Assessment (EIA) requirement is an attempt to tackle pollution problems at an early stage. If the potential environment damage is assessed to be excessive or above the standard thresholds, the investor is required to modify technology or the site of the project. To be a practical abatement measure, EIA's have to be selective. Malaysia has 19 prescribed activities requiring EIA's (mainly large scale energy, transportation, infrastructure, agro-industries and waste treatment and disposal projects, see Table 3A.4 in the appendix to this chapter) for which an EIA is mandatory. The number of EIA reports reviewed by the DOE have increased from 11 in 1988 to 174 in 1991. Of the 334 reports received so far only 30 percent were rejected because of their potential damage to the environment. The review procedure has become more efficient over time as indicated in the decline in the review time from 6.6 months in 1988 to 4.3 months in 1991.

3.23 EIA's are a useful planning tool in addressing potentially serious problems at an early stage. Examples are locating industry away from centers of tourism or urban concentration and incorporating abatement technology in plant design rather than retrofitting, which is very costly. But care must be taken that EIAs are required only in carefully selected sectors and that the clearance time is kept to the minimum. Malaysia does both and, as shown above, does them successfully (compared to the Philippines where EIA requirement is broad-based, and it can take over a year to get clearance). This judicious use of EIA has helped to avoid serious conflicts between the country's development and environmental objectives.

3.24 It must be recognized, however, that excessive reliance on EIA's is expensive and where state-federal interests overlap, can result in ambiguity. In Malaysia, this is frequently the case because state authorities allocate land to projects and give them permission to start construction even before they have

received federal EIA clearance. This takes the bite out of the EIA as a regulatory instrument.

3.25 Contravention licenses and associated fees have started to be used in Malaysia. This is a form of abatement charge, based on the "polluter pays principle". In 1991, a total of 81 and 72 contravention licenses were issued for air and water pollution respectively. Forty percent of these were issued to the food processing industry. Water effluent-fees amounted to RM 138,454.

3.26 Malaysia successfully implemented the "polluter-pays" principle in the palm oil sector, where the effluent charge was combined with strict monitoring. This helped to bring down palm oil water pollution load from a population equivalent of 30 million in the early 1980's to 0.1 million in 1991. However, this is hard to replicate industry-wide because there are many dispersed point sources and monitoring becomes difficult and expensive. For example, in the rapidly growing industrial estate of Pasir Gudang in the state of Johor Bahru, there is only one officer in charge of monitoring pollution. Poorly trained, he cannot always determine whether standards are actually violated. He counts on the support of the DOE representative in Johor Bahru who has many demands on his time.

3.27 Malaysia has started to use fiscal incentives as well to meet its environment objectives. A proposal is under study by the DOE that requires a surcharge to be imposed on potentially polluting products. In this deposit-refund system, the deposit will only be refunded when the product or containers are returned to a collection system. Another proposal being considered by MIDA is to provide tax incentives, for example, tax relief for those who install or implement pollution prevention measures.

3.28 In addition, MIDA gives incentives to encourage proper facilities for the storage, treatment and disposal of hazardous wastes. "Pioneer" status incentive for 5 years will be available to companies which are directly involved in the storage, treatment and disposal of toxic and hazardous wastes in an integrated manner. For those companies that are themselves waste generators and wish to establish facilities to store, treat or dispose of their wastes, either on-site or off-site, they would be eligible for a special allowance at an initial rate of 40 percent and an annual rate of 20 percent for all capital expenditure".[8] As a further incentive to industry MIDA will also extend the current import duty and sales duty and sales tax exemption scheme for machinery, equipment, raw materials and components to them for the storage, treatment and disposal of hazardous wastes.

3.29 In sum, Malaysia currently uses a variety of direct command and control pollution abatement measures such as emissions standards, EIA's and effluent charges. Accompanied by tight monitoring, these measures have worked well in combating pollution in the palm oil sector. However, as industrialization deepens and gathers pace, more indirect and cost-effective interventions would need to be devised.

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[8] Ibid.

Towards a New Abatement Strategy

3.30 In thinking about a new industrial pollution strategy the criterion of cost-effectiveness has to be paramount. This applies not only to the firms that have to incur costs while complying to pollution regulations, but also to the regulating body since it has to incur costs in monitoring. The five elements of a cost-effective strategy are to (i) straighten out the overall incentive structure; (ii) set priorities in terms of industrial sectors to be regulated; (iii) move to market-based regulations such as presumptive charges based on output; (iv) address the special problems of small firms; and (vi) make judicious use of industrial zoning.

Overall Incentive Structure

3.31 The overall industrial incentive structure itself goes a long way towards curbing pollution efficiently. If tax incentives, and other subsidies, result in attracting polluting industry to Malaysia then that would be the first issue to address in the design of an efficient pollution abatement strategy. Malaysia's industrial policy regime is less distorted compared to many developing countries. However, there remain selected pockets of high protection; moreover, many small and medium firms, often the largest sources of pollution, escape the tax net thus enjoying incentives to produce and pollute more. Such incentives to pollute need to be removed.

Setting Priorities

3.32 The economic structure of the industry, in terms of its contribution to the economy's output, employment and investment and the number of firms in existence, is a useful guideline for identifying priority sectors for targeting abatement policies. Table 3.11 presents the structure of each of the nine major industrial polluters in Malaysia.

3.33 In identifying priority sectors for targeting pollution abatement measures, the basic questions to ask are: what is pollution load of the industry and what is its structure in terms of number and size of firms and local/foreign equity etc? The answer to the latter question helps in the choice of direct versus indirect policy instruments for pollution abatement.

3.34 The pollution load of an industry is pollution intensity (pollution per unit of output) multiplied by the total output. This would yield a ranking of industry by pollution load for identifying priority industries for policy action. Unfortunately such data are not available. The DOE reports the most serious offenders in terms of air polluting and hazardous waste generation by their share in total load (Tables 3.2 and 3.5 respectively) and the most serious water polluting industry in terms of the number of point sources (Table 3.3). On these criteria, woodbased industry is the most polluting industry for air, food processing for water and the metal finishing sub-sector in the machinery, engineering and electronics subsectors for hazardous waste. If this selection of industry coincides with the one based on the criterion of pollution load defined above, then these three would be the priority industries for policy action. (Note that the second columns of table 3.2, 3.3 and 3.5 would suggest

a different selection of priority industries. However, this ranking is based on U.S. data. Similar data need to be collected for Malaysia).

3.35 There are 655 firms operating in the woodbased sector, the majority (56.3%) of which are small less than 75 workers. Directly monitoring these firms would be prohibitively expensive. Indirect abatement measures would be more cost-effective. Moreover, foreign equity constitutes just 10.5 percent of the paid up capital in this sector, so that indigenous abatement technologies would need to be developed and local standards established.

3.36 The main source of water pollution is the food processing sector. It consists of 420 firms, 69.8 percent of which are small. Indirect measures would thus be more cost-effective. Foreign equity in this sector, at 41.7 percent, is quite large which suggests that standards operating in the host countries could be tailored to Malaysia's conditions. This would be facilitated by the fact that foreign equity is concentrated in a few large firms.

3.37 Metal finishing sub-sector is concentrated in the electronics and electrical components sector and is the largest producer of hazardous waste. The number of firms in the sector are 374 and are relatively equally distributed among small, medium and large sizes. The foreign equity component, at 71.7 percent, is the highest of all manufacturing industries in Malaysia and it is concentrated in the large firms. The abatement strategy for this sector would be to set host country standards for the large firms and through them reach the small and medium scale vendors.

Table 3.11: The Economic Structure of Polluting industry (as at Dec-1989)

	Assets	*Value Added*	*Foreign equity*	*Exports*	*Employ-ment*	*Small*	*Medium*	*Large*	*Total*
Machinery & Engineering	4.2	3.2	31.4	4.7	7.1	74.2	23.4	2.5	445
Electrical & Electronics	13.41	18.6	71.1	25.1	22.0	39.8	33.2	27.0	374
Textiles	4.4	3.2	39.2	7.3	13.4	49.4	33.7	16.9	256
Food processing	8.1	8.3	41.7	12.8	10.2	69.8	23.6	6.7	420
Chemical	22.0	15.2	35.4	9.4	6.7	69.8	23.6	6.7	420
Palm oil	6.1	6.1	31.3	11.7	3.0	54.9	41.8	3.3	122
Rubber	4.3	4.3	40.3	5.7	7.8	49.5	38.1	12.4	194
Woodbased	10.9	6.1	10.5	16.9	17.8	56.3	36.5	6.7	655
Iron & steel	3.7	3.9	23.4	1.3	1.3	55.5	36.5	7.9	63
Total	26105.24	20591	-	36,572	1,171.2	2172	1102	338	3612

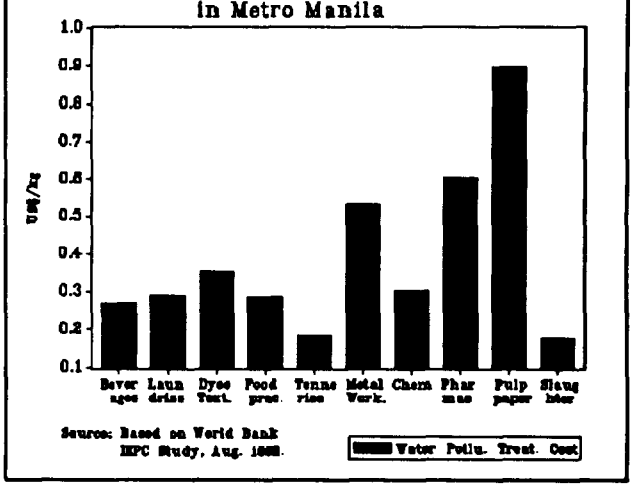
Source: MIDA Companies in production 1991; "Final Report on Dynamic - Input -Output Analysis and Sectoral Projections of the Manufacturing Sector, 1990-2000" UNIDO, March 1992, and Quarterly Bulletin, Bank Negara, December 1992.

*Note *:* Export and Employment Shares are for 1988.

Presumptive Pollution Charges

3.38 Cost-effective pollution abatement requires that low cost firms should reduce pollution emissions first and to a greater extent than high cost ones. For example, the evidence from the Philippines (Figure 3.4, based on Table 3A.3 in the appendix to this chapter) shows that the average treatment cost per kg of effluent among the top 100 polluting industrial units in Manila is US$0.26, but there is considerable variation across firms, ranging from US$0.18 for slaughter houses to US$0.90 for paper and pulp units. Clearly, pollution abatement is cheaper for slaughter houses and they should reduce their effluent first and to a greater degree than paper and pulp units.

Figure 3.4: Average Water Pollution Treatment Cost of Top 100 Industrial Firms in Metro Manila



3.39 Effluent charges levied in violations of emissions standards, as in the palm oil sector in Malaysia, allow for cost variation in abatement and thus are cost-effective. However, as Table 3.11 shows, Malaysia's industrial structure is now quite sophisticated and has many point sources of pollution. Levying emissions charges by point sources would be prohibitively expensive. A better alternative would be a presumptive emissions charge based on known pollution intensities (emissions per unit of firm output) associated with technologies in use. The intensities would be determined on the basis of a baseline emissions inventory survey of Malaysian industry.

3.40 One problem with a presumptive emissions charge is that there is no incentive to switch to cleaner technologies. This can be addressed by devising a system of rebates. Firms that do use cleaner technologies and reduce emissions could claim a refund. This is similar to what is already done in the value added tax and when exporting firms claim rebates on duties paid on imports. Thus the administration of such a charge would be straightforward and would be organized along well-known practices. The rebate system (based on self-reporting) would also enable inexpensive updating of the base-line emissions inventory.

3.41 Presumptive abatement charges could also be used to correct any perverse incentives that might encourage polluting industry to migrate to Malaysia. A case in point is the corporate income tax regime that gives a variety of incentives to investors in selected industries. It was argued in the Bank's last economic report, "Fiscal Reform for Stable Growth" (April, 1992, 10120 MA) that such incentives are a heavy burden on the Treasury and, in any case, incentives is not what attracts investors to Malaysia. Presumptive abatement charges would be a clear signal to investors that Malaysia is not a pollution haven.

Small Firms

3.42 Small firms account for 60 percent of total firms in Malaysia (Table 3.11 above) and often embody dirty technologies so that they need to be addressed separately. Small firms' share in total industrial output is somewhat lower than their share in total number of firms, but they produce more pollutants per unit of output than the large firms. This is especially true in the electronics subsector, where large firms have a substantial foreign presence, and often do meet Malaysia's emissions standards, if not the much stiffer ones of the countries of origin. Such firms also have newer, developed country production processes that embody relatively cleaner technology. In any case large firms are few and are easier to monitor.

3.43 In sectors where sub-contracting arrangements abound (as in the electronics sub-sector), small vendors could be reached by requiring the large firms to keep a comprehensive pollution inventory. The inventory would include the emissions produced in the processes subcontracted out. Presumptive charges levied on large firms, combined with rebates, could then give them the incentive to clean up their vendors in the most cost-effective way. This would lower the monitoring burden on the regulating agency considerably.

3.44 Whether small firms are reached through their parent companies or directly, technical assistance will be needed to introduce cleaner technologies. The lessons of PORIM and the Rubber Research Institute's (RRIM) success in technical assistance to palm oil and rubber firms could be applied to small firms in other sectors. The costs of such assistance are estimated to be reasonably low: between 1980-83, at the height of their activity, PORIM spent $1.2 million on R&D, while RRIM was allocated RM 2 million in the Fifth Malaysia Plan in 1986.

3.45 One rewarding area for cost-effective pollution abatement in the small firms would be the propagation of waste minimizing techniques. The waste minimization feasibility study carried out by the government in the electroplating industry shows that between 50-90 percent waste reduction can be achieved at very low cost and worth a short pay-back period (Table 3.12). The feasibility results for the capacitor manufacturing sector are equally impressive (Table 3.13).

Table 3.12: ELPC Summary of Economic Feasibility Study for Electroplating Industry Waste Minimization.

Description of Options	*Methods*	*Percentage Waste Reduction (%)*	*Capital Costs ($)*	*Monthly Cost ($/month)*	*Monthly Savings ($/month)*	*Pay-back Period (month)*
1. Drag-out Minimization	Use of drain boards	50	315	--	241	1.3
2. Extension* of Bath Life	Use of deionized water	50	582	38	241	2.9
3. Rinse water Minimization	Use of spray rinsing	50	2,825	--	29	8.1 years
4. Good Operating	Use of plastic media	90	17,900	2,519/yr	6,607/yr	4.4 years

* Economic analysis was performed in conjunction with the implementation of drain boards.

Source: MIDA, SMI Section.

Table 3.13: ELC Summary of Electronic Capacitor Manufacturing Waste Minimization Options

Waste Source	*Minimization Option*	*Waste Reduction*		*Net Annual Savings*	*Capital Costs*	*Payback Years*
		gal/yr	percent			
Ball Mills and Transfer Pots	Segregate and recycle RM-513 wastes.	720	28.8	$6,040	$25,750	4.3
	Standardize solvent used and recycle.	2,150	86.0	$19,130	$25,750	1.3
Slurry Application Systems	Segregate and recycle cleaning waste.	725	96.7	$5,400	$25,750	4.8
	Use bag type filters.	–	90.0	$1,260	$23,950	19.0
	Use metal mesh type filters.	–	100.0	$6,660	$9,830	1.5
General Cleaning with Isopropyl Alcohol	Segregate and recycle cleaning waste.	2,350	50	$11,650	$25,750	2.2
TCA Primary Recovery	Install a secondary recovery system.	2,105	73.3	$7,100	$25,750	3.6
All Waste Sources Shown Above	Use a common batch still for about methods	5,810	53.3	$30,190	$25,750	0.9

Source: MIDA, SMI Section.

Industrial Zoning

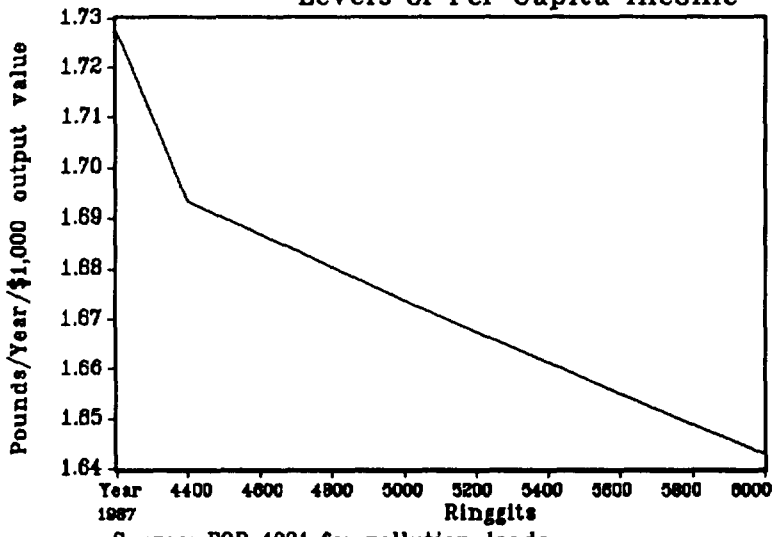
3.46 Malaysia's experience with industrial zones is a good one, in particular the success of export promotion zones is well known. The zones have worked well because the scale economies in the provision of infrastructure have been successfully exploited. Such economies also exist for the infrastructure to collect, treat and safely dispose off industrial pollutants, especially hazardous waste. Pollution abatement within industrial zones could be made cost-effective by holding local authorities, under whose jurisdiction industrial zones lie, accountable for the total emissions generated. This would lower monitoring costs and would leave it up to the local authority to decide the least-cost abatement solutions.

3.47 However, the zoning option must be used judiciously. Small firms should not be herded too quickly into zones because many might not survive the dislocation. Their existence may depend crucially on the fact that the use of a spare room in the house or backyards reduces overheads costs. In any case, such small polluters may generate high pollution per ton of output produced but may contribute just a fraction to total output.

C. Special Issues in Industrial Hazardous Waste

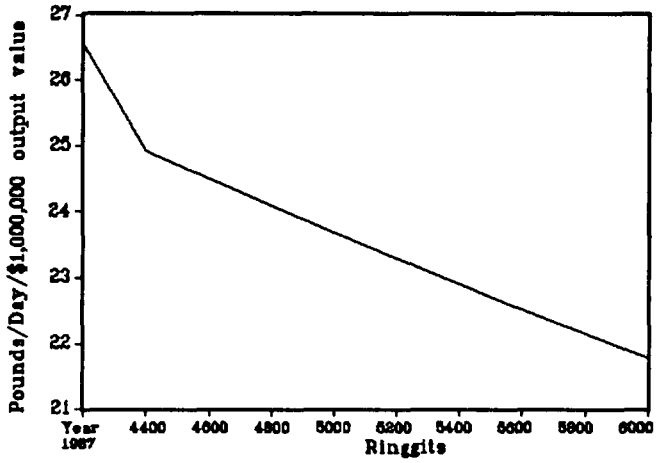
3.48 As Malaysia develops and incomes rise, the industrial structure will change. The change will be towards more sophisticated industry that unfortunately also generates a large amount of hazardous and toxic waste per unit of output. This is depicted in Figures 3.5a to 3.5c, which are based on IPPS projections of industrial structure. The turning point is reached at per capita income levels of US$4400, or nearly one and a half times the current levels, when hazardous waste pollution will begin to decline. This will in part be due to stringent regulation and technological change in the manufacturing sector. Moreover, at higher income levels, the share of less polluting services sector will increase in the economy.

Figure 3.5a: Total Suspended Particulates Emissions Projections by Levels of Per Capita Income



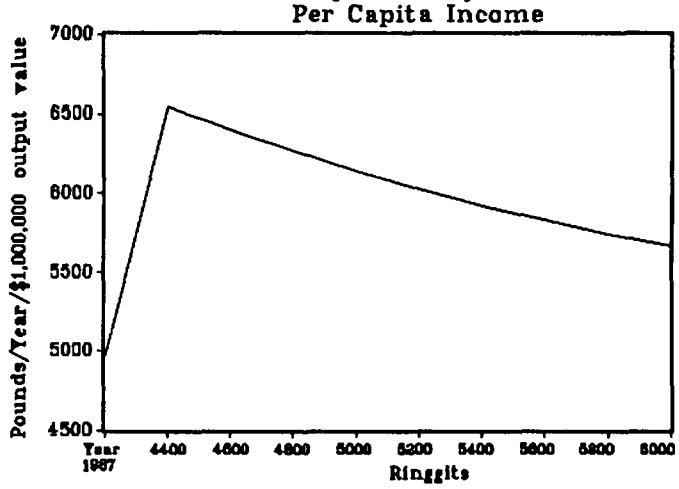
Source: EQR 1991 for pollution loads;
World Bank for pollution intensities.

Figure 3.5b: Total BOD Discharges Projections by Levels of Per Capita Income



Source: EQR 1991 for pollution loads; World Bank for pollution intensities.

Figure 3.5c: Total Toxicity Discharges Projections by Levels of Per Capita Income



Source: EQR 1991 for pollution loads; World Bank for pollution intensities.

3.49 These trends suggest that in the immediate future, the abatement of hazardous waste will take on greater urgency. The cost-effective strategy for hazardous waste treatment would, in addition to the common elements of the strategy discussed in section B, involve paying close attention to the following: (i) tightening up hazardous waste legislation and its enforcement; (ii) improving

the data and skill base for regulating waste; (iii) tackling those wastes first that have the highest pay-off in terms of exposure risk reduction per ringgit spent on abatement; (iv) attending to pollution in industry dominated by foreign investors by setting the higher standards of country of origin and, finally (v) drawing lessons from the international experience in hazardous waste management while designing the regulatory framework for the private delivery of collection, treatment and disposal services.

Strengthening Hazardous Waste Control

3.50 Currently, hazardous waste is controlled through command and control policies (modelled on the European and American experience), which consist of a comprehensive legislation and penalties for violations, EIA's and an over-stretched enforcement mechanism.

Legislation

3.51 The Environmental Quality Act of 1974 is the main regulatory instrument for controlling the quality of the environment in Malaysia. Not until 1989, however, was specific legislation put in place to regulate the storage, transport, treatment and disposal of hazardous wastes. The regulations are intended to control and manage the generation, storage, transportation, recycling, treatment, and destruction or disposal of toxic and hazardous wastes. Scheduled wastes are classified into 58 broad categories and 107 subcategories, ranging from the very large industries such as petroleum, paint, pharmaceutical, rubber, and chemicals to workshop operators. Twenty nine of the categories apply to the electronics industry.

3.52 Scheduled Waste Regulation 1989 contains rules governing the following issues:

- definition of scheduled wastes
- requirements for notification by waste generators
- disposal of scheduled wastes
- waste reduction and minimization requirements
- storage of scheduled wastes
- consignment note/manifest system
- waste information (waste card) during transport
- spillage and accidental discharge
- penalties for offenses.

3.53 Prescribed Premises Order 1989 defines six types of hazardous waste treatment and disposal facilities that require a written permit and a license from the DOE:

- land treatment facilities, such as sludge farms
- off-site recovery facilities
- off-site treatment facilities
- scheduled waste incinerators
- off-site storage facilities, including transportation
- secure landfills for the disposal of scheduled wastes

3.54 These facilities are also required to submit Environmental Impact Assessment (EIA) report to the DOE under Environmental Impact Assessment Order 1987. Malaysia has no intermediate treatment facilities or secure landfills for scheduled wastes. The DOE is studying standards for these facilities, in consultation with a consortium led by I Kruger Engineering AS that will build the first centralized treatment center.

3.55 The procedures for license application and renewals, ownership transfers, record keeping, and submission to the DOE are specified in Scheduled Wastes Treatment and Disposal Facilities Order 1989.

Penalties

3.56 Malaysia' environmental regulations are relatively comprehensive and provide a good, basic legal framework. Administrative penalties under these regulations include fines of up to M$500. More serious offenders can be prosecuted in court. The maximum legal penalty is M$10,000, 2 years imprisonment, or both. A fine of M$1,000 a day also can be imposed as long as the violation continues.

EIA's

3.57 The law also has provisions designed to prevent industries from engaging in undesirable polluting activities in the first place. Under the Industrial Coordination Act, new applicants for manufacturing licenses in the chemical, petrochemicals, nonferrous metal, non-metallic, iron and steel, shipyard, and pulp and paper industries must submit EIA to the DOE.

3.58 The technical unit of the DOE conducts the initial screening of the EIA. As of December 1992, only 5 out of more than 300 EIAs have required further public screening. A DOE officer stationed in the Malaysian Industrial Development Authority (MIDA) to explain new environmental regulations to new investors and assist them in preparing EIA. The officer also screens out clearly undesirable projects, such as a hazardous waste treatment center that would brings hazardous wastes from abroad.

Enforcement Problems

3.59 Seven officers in the hazardous waste section of the DOE and 30 monitoring officers in the 10 regional offices of the department are in charge of enforcing hazardous waste-related regulations. The regional offices are responsible not only for scheduled wastes but for other environmental problems as well.

3.60 The DOE currently discourages on-site incineration of hazardous wastes because it is difficult to ensure that small incinerators meet emissions standards. This has resulted in factories storing increasing quantities of waste on premises. Thus, the DOE and its regional offices are concerned primarily with the notifications and manifest notes complied by industries and the safety of hazardous wastes stored on factory premises.

3.61 The current on-site storage is a large step forward from past practice of freely emitting hazardous substances into air, water, and land. There are, however, three crucial problems of affecting regulations and enforcement.

3.62 The first is the lack of precise definitions of hazardous wastes. Scheduled Wastes Regulation 1989 does not clearly distinguish hazardous (scheduled) waste from non-hazardous wastes by concentration of toxic substances. Thus there are cases in which the DOE and particular factories are at odds, such as the case of sludge from the waste water treatment facility at an iron mill, which the DOE considers scheduled waste requiring proper storage but which the iron mill considers nontoxic and so is disposing of it at an off-site dump. Individual manufacturers appear to negotiate with the DOE on an ad hoc basis to exempt their wastes from the hazardous waste categories by providing scientific proof that their wastes are not hazardous.

3.63 Japan avoids confusion about hazardous wastes by requiring all industrial wastes, hazardous and nonhazardous, to be treated separately from municipal wastes and by clearly defining types of industrial wastes. All industrial wastes containing certain toxic substances above specified levels are considered hazardous industrial wastes. The standards for hazardous wastes prescribe test procedures, methods of intermediate treatment, and disposal sites and structures by type of hazardous substance.

3.64 The second enforcement problem is the absence of off-site and other alternative means of storage. Storing the sludge in drums and similar receptacles on-site until appropriate disposal facilities are available is just a temporary holding measure and only delays ultimate disposal to a later date. Besides, storage in drums offers unnecessary exposure to possible leakage and damage. According to the DOE's survey, 72 factories in Selangor and 18 in Penang are having acute problems to store their toxic wastes on their premises. The Selangor state government is trying to develop its own control storage depots for factories.

3.65 Some large firms are seeking their own expensive solutions. The DOE has issued nine approvals for sending hazardous wastes abroad for treatment. The destinations of the waste include Japan, U.K., USA and Singapore.

3.66 The third problem is difficulty of detecting illegal discharges and dumping of toxic substances into environmental media. Hazardous wastes may be mixed in with municipal dump sites. Small and medium-scale manufacturers, in particular, still discharge toxic substances into air, water, and land without penalty, which combined with understaffing and a lack of technical expertise in the DOE makes monitoring industry compliance partial, at best.

3.67 Thus pollution by hazardous wastes continues. The Environmental Quality Report of 1991 stated that heavy metals continue to be found in selected rivers with a history of heavy metal pollution. Levels of heavy metal in rivers along the west coast, in particular, suggest violations of regulations.

Monitoring tools have found high levels of arsenic, cadmium, copper, mercury, lead, and zinc.[9]

Improving the Data and Skill Base

3.68 The DOE has recently started to collect more comprehensive and up to-date information. All industries that generate scheduled hazardous waste are required to submit notification forms within one month of waste generation detailing the types and quantities of scheduled hazardous wastes (scheduled wastes are all hazardous wastes covered under the environmental protection legislation of 1989). Of some 1,000 large firms and 1,000 small firms are required to submit the forms to the DOE, only 680 large factories had done so as of December 1992.

3.69 The DOE has embarked on a nationwide screening of manufacturers to determine why compliance is so low and to review the accuracy of the submitted data. Stringent monitoring of the self-reporting system will probably be needed to prevent under-reporting. To strengthen its data management capacity, the DOE also plans to develop a hazardous waste inventory data base and chemical data base.

3.70 The 680 factories that submitted the forms reported hazardous waste totaling 174,000 tons a year. Hazardous wastes from textile firms accounted for the most waste (51.9%), followed by metal sludge/metal (15.2%), oil and hydrocarbon (10.7%), dross/slog clinker ash (7.5%), and resin and glue (4.5%). Because the data are incomplete they cannot be compared with those of the 1988 report. It can nonetheless be said that metal finishing and textiles are two of the largest generators of hazardous wastes.

3.71 Malaysia's primary objective in industrial hazardous waste management is to reduce the quantity of waste released by building up its environmental infrastructure. A first step would be to improve production processes and the choice of products and product materials. The second would be to segregate or recover material resources that may be reusable. The next step is to separate the hazardous components from the waste streams that remain. This step typically requires on-site pretreatment of industrial wastes, but it may also involve modification of production processes as well as appropriate methods of handling and storing chemical substances to facilitate their separation. Together, these measures can greatly reduce the volume of hazardous waste that remains and that requires special treatment.

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[9] Pinang state experienced the worst mercury pollution, namely Sg.pri, Sg. Kerian, and Sg. Jejawi. These rivers exceeded the standard value of 0.004 mg/l. Lead was founded the most in the monitored rivers in Johor state and the most of them exceeded the standard value of 0.02mg/l. Other rivers such as Sg. Bernam in Perak; Sg. Juru and Sg. Jejawi in Pinang; Sg; Muda in Kedah; Sg. Langat, Tengi, Buloh and Sepang in Selangor; Sg. Duyung in Melaka; Sg. Kuantan in Pahang; Sg. Golol in Kelantan; and Sg. Dungun, Setiu. Betiu, and Sg. Terengganu in Terengganu also exceeded the limits.

3.72 Putting these measures in place will require the development of technical expertise, as well as investment in environmental protection measures by individual firms. Malaysia recently adopted tax incentives for firms investing in environmental equipment and for promotional activities by firms engaged in environmental clean-up activities. Government assistance for pollution control measures in targeted industries may be effective, if backed up by stringent monitoring. In addition, establishing clear criteria for defining hazardous waste will make it easier for industry to comply with the law.

3.73 Regulations alone, however, will not improve environmental quality. Skilled environmental planners and engineers are needed to draft regulations and enforce them. Training will be needed to bring staff up to date on appropriate environmental practices. And establishing a new private-led treatment center for handling hazardous wastes does not release the government from its obligation to monitor waste generation and waste treatment. Doing so effectively will require strengthening the DOE's institutional capacity and developing new responsibility-sharing arrangements with state governments.

Setting Priorities for Reducing Risk of Exposure to Hazardous Waste

3.74 Industrial hazardous wastes can be classified in the three large groups: by-products generated in the production processes, sludge resulting from waste water treatment, and toxics whose expiration data has passed. No one knows how much untreated hazardous waste factories in Malaysia discharge or how much hazardous waste goes into municipal dumps. Both are a threat to human health. Mixing with municipal wastes exposes people living near municipal dumps to hazardous constituents that can pose health risks. The health of residents living near factories that emit untreated toxic substances is similarly threatened.

3.75 Because not all risks are equal and not all hazardous waste problems can be treated at once, a system of risk assessment is needed that permits ranking. The ranking can be used to determine which wastes should be treated first based on cost effectiveness of risk reduction. while the lack of adequate data limits the accuracy of the exercise to some extent, it is still possible to produce a rough measure of relative risk factors and cost effectiveness. An example presented in Table 3.14, which is based on a measure developed for Thailand (detailed calculations are presented in Annex table 3A.5).

3.76 Table 3.14 shows the ranking of hazardous waste by environmental risk (calculated by taking into account volume of waste, the exposed population and health risk) and by cost-effectiveness of risk reduction per million Malaysian Ringgit spent. Thus, priority in the collection, treatment, and disposal of hazardous wastes should go to heavy metal, alkaline wastes, and acid waste. Heavy metal sludge and solids present the greatest environmental risk because of the large quantities involved and the high relative risk factor, and their treatment has the highest cost-effectiveness rating (risk reduction per ringgit of expenditure). Thus, although more accurate risk assessment is still needed and will require completing of the hazardous waste inventory, there is good

reason to begin to focus on industry that generates waste containing heavy metals.

3.77 The example discussed here is illustrative of the type of information needed to prioritize action for reducing the risk of exposure to hazardous waste. Such information needs to be collected routinely and update in keeping with industrial growth calculations of risk and its management.

Table 3.14: Hazardous Waste Ranking By Environment Risk and Risk Reduction (1987)

Hazardous Waste Type	Environment Risk	Risk Reduction per million RM
Heavy metal sludges and solids	1	1
Acid wastes	2	3
Alkaline wastes	3	2
Aqueous organic residues	4	5
Photo wastes	5	4
Liquid organic residues-NH	6	7
Organic sludges and solids (H)	7	9
Solvents (H)	8	8
Inorganic sludges and solids	9	6

See Table 3A.5 in the Annex for detailed calculations and sources.

Foreign Investment and Hazardous Waste

3.78 Because of its macroeconomic stability, an educated and disciplined labor force, good infrastructure and a welcoming attitude, Malaysia is a very attractive destination for foreign investors. After petroleum and gas exploration and extraction, the bulk of foreign investment has gone into basic metals and electrical and electrical components sector. Between 1986-1992, 31 percent of total foreign investment went into these two sectors, making Malaysia the largest producer and exporter of semiconductors in the ASEAN region. But this has also contributed to hazardous waste generation and has increased risk of exposure to this deadly form of pollution.

3.79 Much more information than is currently available is needed for a comprehensive assessment of the relationship between foreign investment and the

environment, but a recent case in Ipoh (see Box 3.1 below) is suggestive of a trend, particularly in the electronics industry. The sector intensively uses hazardous chemicals (see section B) and it is dominated by Japanese and U.S. multinationals. Government involvement seeking forward-looking cooperation with foreign investors would be needed for successful abatement. Japan, for instance, is quite keen to ensure that Japanese investors abroad adhere to higher standards of pollution abatement (see Box 3.2).

3.80 There is also some concern that a new environmental movement in Taiwan may be pushing some pollution-intensive Taiwanese industries such as basic metal operations to relocate.[10] This has by no means been proven, however. The relocations may simply reflect the increased demand in Malaysia for basic materials for infrastructure construction and expanding industrial linkages. Further research is clearly needed.[11]

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[10] Jo Teruhiko "Taiwan/kaihatsu dokusai no tsuke to shintaisei (Negative results by political monopoly and new regime in Taiwan" in Jun Kitahara ed., Asia no NIEs to daisan sekai no hatten (Asian NIEs and the third world development) (Tokyo: 1991)

[11] A U.N. study found that movement of transnational corporations from industrialized to developing countries were not significantly motivated by host country's environmental regulations and implementation (except for the production of certain heavy metals, asbestos, benzidine dyes, and pesticides). Numerous factors can explain why this could not be case y: a low weight of environmental control costs in overall production costs; a willingness by multinationals to upgrade their technological levels to meet expected high future environmental and safety standards in developing countries; and the emergence of new technologies that are more efficient and cleaner, making old pollution-intensive technologies less economically viable. Environmental Aspect of the Activities of Transnational Corporations (New York: the United Nations Publications, 1985).

Box 3.1. Pollution and Foreign Investment: A case in Ipoh

With manufacturing output expanding at double-digit rates in Malaysia, hazardous waste-related problems are intensifying. Several cases of illegal dumping of toxic wastes have come to light in recent years. In Perak state, there was a report of illegally dumped drums full of hazardous waste, believed to have been brought from abroad. A particularly well documented case is that of Asian Rare Earth Co. at Ipoh in Perak state.

Asian Rare Earth Co., a joint venture between Mitsubishi Chemical Co. and local capital, in operation since 1983, is the center of the dispute. The factory extracts rare earth from monazite, a substance found in tin tailings, and produces a by-product, thorium, which is a radioactive material. It was the first company licensed to process monazite to produce yttrium and other rare earth chlorides used in color television screens and other electronics products.

In response to claims that the company was improperly storing waste, tying it in plastic bags, or dumping it into a nearby pond and river, the Ipoh High Court (in July 1992) ruled that there was creditable evidence offered by experts of a rise in leukemia cases, infant death, and high lead levels in village children as a result of the company's activities. The high court ordered that the company be closed down immediately. Responding to the ruling, the company appealed to the Supreme Court, the final court of appeal in Malaysia.

Although still pending at the Supreme Court, this case illustrates several important concerns: an immediate threat to public health due to certain types of manufacturing activities when appropriate environmental protection measures are not taken; inviting dirty industries from abroad through foreign investment promotion measures without adequate screening; weaknesses in Malaysian law that requires plaintiffs to prove actual loss or damage, thus posing difficulties in situations when the health risks (of cancer etc) arise in the long-term.

Box 3.2.

A MITI questionnaires in 1991 on the environmental performance of Japanese manufacturers in developing countries found that less than 10% applied the same environmental protection measures in developing countries as they did in Japan. Majority of them (60%) reported that they took only those measures required to meet local standards, and approximately 10% admitted to having environmental disputes with local residents. Following these revelations, the Ministry of International Trade and Industry (MITI) announced that it would strengthen its instructions to Japanese manufacturers operating in developing countries to comply with environmental standards equivalent to those of Japan. As a result of the new MITI instructions, many Japanese manufacturers are now expected to install new environmental protection equipment in their factories in developing countries. MITI has also offered help to host developing countries for strengthening institutional capability for environment policy design and monitoring.

A Private-led Approach to Hazardous Waste Management

3.81 In 1987, when problems began to mount, the government undertook, with the help of a USAID grant, a study of the hazardous waste problem in Malaysia. The need for a treatment facility was established and the choices were for (i) the DOE to own and operate the facility, (ii) partial privatization and (ii)

total privatization. In 1988, the cabinet decided to go for the third option and the DOE invited proposals from private parties. A total of 15 proposals were received , of which 2, Chem-security and a consortium led by I.Krueger were short listed to design-build-operate the facility. In December 1991, Chem-security pulled out and in February 1992 the government gave the exclusive rights for the facility to a consortium (led by a Danish firm, I Kruger Engineering AS) to build, operate, and maintain M$200 million (US$77 million) centralized hazardous waste treatment plant. No new entrants are permitted in the hazardous waste treatment business until 2005.

3.82 Under the project, waste transfer stations and attached landfills will be provided strategic locations such as Penang/Perak border and in Terengganu and Johor States and, a centralized treatment and disposal facility located at Bukit Nanas near Port Dickson in the State of Negeri Sembilan. Given that it will take at least another two years or so to materialize, to relieve the backlog of toxic wastes, the consortium proposes to install a temporary storage facility (capacity of 20,000 tons) at the plant site.

3.83 The center is expected to have a treatment capacity of more than 400,000 tons a year by the year 2000 (95% of the country's total hazardous waste production). Facilities will include a rotary kiln-type incinerator with liquid, sludge, and solid waste feeding provisions and a secondary combustion chamber. A gas cleaning system and an ash and slag handling system will be provided. More than half the total waste brought to the plant is expected to be stable and will be directly landfilled.[12]

3.84 This centralized model is an adaptation of the Danish system to suit a small country and permits exploitation of scale economies in waste treatment. In Denmark (which is considered as a leading country in the waste management field), the local governments jointly set up a company which collects, treats, and disposes of all the country's hazardous wastes. Monitoring is simplified as well by having a single, centralized treatment plant.

3.85 Private sector ownership and management of the waste plant means that waste generators will have to bear the full cost of investment and operation. Service fees have not been established because the government has not yet announced the effluent standards it will impose on the plant nor how much waste it is expected to handle. Costs could be as high as in industrial countries, making it difficult to pass all costs to the industries. Cost is particularly

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[12] I Kruger and others, Environmental Impact Assessment on Malaysia Integrated Scheduled Wastes Collection, Treatment and Disposal Project (Kuala Lumpur: 1992).

high for many industries that, until recently, were able to get away with improper discharge of waste.[13]

3.86 It is expected, therefore that large firms, especially multinationals, will be the first customers of the new facility because they are more sensitive to stringent regulation and are financially capable of meeting the cost of service. Meanwhile, small and medium-scale firms are unlikely to seek the service. The DOE would face difficulties in enforcing standards since such firms are numerous and many are not even officially registered.

3.87 Transportation costs are another concern. To reduce these costs, secure landfills will be constructed alongside waste transfer stations for direct disposal requiring no intermediate treatment. Since waste generation is concentrated in three major industrial states, disposal of stable waste locally should be more cost-effective than sending it to the landfill attached to a centralized location.

3.88 The current status of the proposal is that the detailed Environment Impact Assessment is being reviewed with respect to the suitability of the cite, the technical aspects of the incinerator, emissions, treatment and final disposal and the firming of the assumptions made regarding the quantity and quality of hazard waste in Malaysia given in the Dames and Moore.

3.89 At least four outstanding issues need to be examined before finalizing the contract. These are: (i) the quantity of hazardous waste; a correct estimate of total quantity will influence the total investment to be made in the facility as well as the price to be charged; moreover, the current policy disallowing import of hazardous waste needs to be clarified especially with the respect to the allowed deposit of sludges by ships; (ii) safety standards regarding transportation and transfer stations are not in the current EIA in any detail; these, along with Emergency Response Plans on site as well as during transportation and definition of owner and operator liabilities during transportation, need to be clarified; (iii) the responsibility to be clearly assigned for adequate coverage of small generators of hazardous waste and cooperative solutions for common treatment facilities need to be explored and (iv) institutional interaction modes between DOE as the technical watchdog over I. Krueger, and between EPU as the regulator of the monopoly need be clearly defined.

3.90 In designing the privatization strategy, the authorities might draw on Malaysia's successful past privatization experience (reviewed in Annex 1) as well

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[13] Hong Kong has just opened a private-run HK$1.3 billion (US$167) centralized hazardous waste treatment plant that is expected to handle 100,000 tons of waste annually. Hong Kong's waste problem is especially difficult because approximately 90% of waste generators small-scale firms, employing fewer than 50 workers. Because those generators lack financial and technical ability to treat waste, the government is expected to pay the plant's service fees (or all generators can get free of charge treatment services). Far Eastern Economic Review, January 1993, p.43.

as on lessons from other countries. The latter are briefly reviewed in the next section.

Lessons for Malaysia from an International Comparison in Hazardous Waste Management

3.91 Some of the solutions Japan and Thailand have found for dealing with issues of industrial waste management may be applicable in Malaysia. A comparison of the salient features of hazardous waste management practice in the three countries is presented in Table 3.15. The lessons that emerge are:

(i) In Japan, the active role of local government in implementing regulations has much to recommended it since most environmental problems are location specific, and local government can work directly with the local residents to resolve the problems. The sharing of administrative responsibilities between the central and local governments, helps build up institutional capacity at local level. This approach, however, would require strengthening of local government institutions in Malaysia (see chapter 5 for further discussion).

(ii) Malaysia may consider a contract arrangement similar to the one in Thailand between generators and the treatment center for the center to get a steady supply of waste. In addition, MIDA in Malaysia may play a more assertive role to tackle industrial waste management issues as Thailand's IWD and Japan's MITI.

(iii) On the other hand, under the government-led approach in Thailand, environmental businesses play a relatively limited role. The treatment fees determined by the government also do not necessarily reflect appropriate environmental costs. Furthermore, both in Thailand and Japan, the subsidy for preventing industrial pollution is administratively cumbersome and imposes a financial burden on the government (essentially on the public). In designing a similar subsidy, Malaysia may want to have a more transparent government procedure to avoid abuses.

(iv) It is essential to improve the environmental practices of small firms. In Japan, this was done by incorporating environmental concerns into small industry promotion policy. As in Japan and Thailand, the Malaysian government might consider hazardous waste treatment facilities as necessary environmental infrastructure for small sector industrial activity, and worthy of public subsidy since the society benefits as a whole.

(v) A clearer definition of hazardous waste, as in Japan, would be necessary for Malaysia to minimize confusion and cope with the growing problem of industrial waste as a whole.

(vi) An advantage of the Japanese approach of many subcontractors, as opposed to Malaysia's proposed single consortium, is that competition among subcontractors works positively for waste generators. This has to be

weighed against the disadvantage of the increased difficulty of monitoring many agents by local governments with weak administrative capabilities.

(vii) Japan is seeking to play a more active role in providing assistance for specific environmental objectives, and this effort has increased significantly in recent years. Malaysia can take advantage of these opportunities for adopting advanced pollution control technologies as well as for improving environmental policies and their implementation.

Table 3.15: Cross Regional Comparison of Industrial Hazardous waste Management

Issue	*Malaysia*	*Thailand*	*Japan*
Who treats hazardous waste?	A single consortium	A subcontracted private firm	Generators & subcontractors
Service coverage	Initially large firms only	Small firms especially targeted, but large firms also have access.	Wide range of coverage
Quality of service	Potentially Good	Basic	Good
Cost borne by waste generator	Potentially high (perhaps as high as in dev. countries)	Insignificant	Lower than in Malaysia
Government subsidy	None initially	Yes	Yes
Government monitoring of treatment facilities	Easy, since govt. works closely with a consortium	Easy because govt. works with operators	Difficult because numerous small subcontractors have to be monitored
Efficiency in waste management	Efficient because of the polluter pays principle.	Possibly inefficient because of the subsidies	Probably efficient because of the competition among many subcontractors.
Effect on industry competitiveness	Negative given high service fees	Neutral	Neutral

Appendix III A.1. An Illustrative Set of Questions Questionnaire for Collecting Information on Firms' Compliance Costs For Pollution Abatement

Suggested Questions on FMM Members' Concerns Regarding Environmental Regulations

1. (a) Have you incurred expenses to meet government's environmental regulations? (i) Yes_____ (ii) No _____.

   (b) If yes, were these aimed at lowering
   (i) air pollution _____, (ii) _____,
   (iii) both _____, (iv) other (specify) _____?

   (c) How much expenses did you incur? (i) total amount _____,
   (ii) proportion of total taxed investment _____,
   (iii) proportion of total value of output _____.

2. (a) Does your firm generate hazardous/toxic waste?
   (i) Yes _____, (ii) No _____.

   (b) If yes, what is the estimated rental value of the space where you store it _____? How much toxic waste is generated (tons per year) _____?

   (c) What percentage of your storage capacity have you used up?
   (i) Percentage _____.

Appendix III A.2. Hazardous Waste Management Practice In Thailand and Japan

Thailand: Strong Government Involvement

1. Thailand, with manufacturing growth rates similar to Malaysia's, has taken a different approach to hazardous waste management. In 1989, to stop the pollution of water by small family-run dyeing and electroplating factories, the government built Bang Khuntien Industrial Hazardous Waste Treatment Center in a western suburb of Bangkok. The center, the first of its kind in Thailand and in the region,now also serves large factories, including multinationals.

2. The pilot project cost some 31.5 million baht (US$1.26 million), B22 million of it for the basic treatment facilities (for chemical/physical and solidification treatment) and a laboratory. To reduce administrative costs, the IWD contracted out the management and operation of the center. The operating firm is solely responsible for all waste collection, treatment, and disposal.

3. The Industrial Work Department (IWD) under the Ministry of Industry supervises the firm's management and operation of the center and collects a monthly rental fee of B50,000 (US$2,000) and a royalty of B3 (US$0.12) per ton of waste brought to the center. The department retains the ownership of the center and the right to define or approve treatment specifications and the service fees.

4. The center has a treatment capacity of 300 tons liquid waste a day from small dyeing and electroplating factories and 30 tons sludge a day from large electronics and car assembling factories. The center treats an estimated 15% of the country's total industrial hazardous waste, from some 400 firms.

5. Service fees are B45 (less than US$2) a ton for liquid waste and B500 (US$20) a ton for solid waste. Transportation fees are B2 (US$0.08) per kilometer per ton. Government subsidies keep the fees low.[14]

6. The project is considered successful even though the safety margin is thinning as residential areas move closer and the accident risk of transporting hazardous waste on congested roads increases. The key factor for the success was a contracting arrangement between the IWD and the factories that supply a given quantity of waste to the treatment center at an agreed upon price that is sufficient to cover the center's operating costs.

7. To treat more hazardous types of waste, the government has proposed the establishment of an environmental fund to construct hazardous waste treatment facilities throughout the country. The environmental fund would be financed from charges to waste generators for the treatment services. To initiate the plan, the government allocated a budget of B57 million (US$2.3 million) for basic

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[14] Information came from Brochure on Bangkhuntien Industrial Hazardous Waste Treatment Center, 1988,and from conducted interviews at the plant.

infrastructure and preparatory works for the projects at two locations. The U.N.Industrial Development Organization is also helping in the design of the project.

8. In sum, Thailand's approach provides a useful model of active (but financially modest) government involvement through planning and financing treatment facilities for hazardous waste management.

Japan: Government & Business Collaboration

9. Although Japan has, by and large, successfully managed its environment, industrial and hazardous waste issues are still a pressing problem. Japan's diversified and intensive manufacturing activities produces large quantities of industrial wastes - in 1985, 312 million tons, eight times the volume of household wastes. And the quantity of that waste has grown rapidly, at a yearly average rate 6.8% from 1980 to 1985. [15]

10. Japan defines industrial wastes rigorously and requires that these be treated separately from household wastes according to the specified standards. Industrial hazardous wastes are defined as industrial wastes that contain hazardous substances above acceptable levels of concentration.

11. Industries are responsible for safely treating and disposing of their own hazardous and nonhazardous wastes. Firms are expected to pay for the treatment and disposal of their waste since it is generated in the process of the firms' profit making activities.

12. Under the terms of the Waste Disposal and Public Cleaning Law, firms are permitted to subcontract the treatment and disposal of their waste. As a result, a whole new industry of numerous waste treatment subcontractors has sprouted that collects, transports, and disposes of industrial wastes. There were some 62,500 licensed subcontractors in 1988, though many specialize only in transporting wastes.

13. The national government is involved primarily in policy and drafting regulations of waste management: The Ministry of Health and Welfare drafts legislation on wastes and assists local governments in dealing with hazardous wastes. The Environmental Agency sets up standards of waste treatment and disposal. The Ministry of International Trade and Industry (MITI) establishes the guidelines on environmental practices for industries. The ministries carefully coordinate their activities, to avoid inconsistencies.

14. The national government has also provided systematic financial support for industries' environmentally related investments. Low-interest loans through the Japan Environmental Corporation, established by the government in 1965, and tax exemptions for investment in environmental facilities have become major

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[15] Yoshiaki Ishikawa, Korekara no haikibutsu shori to chikyu kankyo (Waste management and the world environment) (Tokyo: Chuo hoki, 1992).

instruments of government policy to promote pollution control measures in industry.[16] The corporation provides subsidized loans for a wide range of environmental projects from the financing of industrial pollution prevention measures to the relocation of industries; prevention of groundwater contamination, and joint facilities for industrial waste.[17]

15. MITI has also worked hard to integrated environmental considerations into industrial and energy policies. Since the 1970s, it has assisted in the development of an environmental sanitation and pollution control industry (including industrial waste treatment subcontractors) and has facilitated the joint development with private business of industrial pollution protection measures.[18]

16. The prefectural governments implement environmental regulations under the central government's initiatives. They license and monitor the industrial waste treatment subcontractors in their jurisdiction, collect data, plan prefectural industrial waste management, monitor manifest system, and provide environmental technical assistance for small and medium-scale firms (some of municipal government also carry out similar tasks).

17. Local governments have also helped to set up cooperatives to carry out industrial waste treatment projects. The government has got involved because of the public's general skepticism about the safety of industrial waste-related centers and because of the difficulty of finding locations for treatment and disposal facilities. In 1991, approximately 11% of the intermediate treatment facilities (973 out of 9,185) and 7% of final disposal facilities (172 out of 2,515) were run by public sector.[19]

18. Despite the relatively stringent controls, it is not easy to treat and dispose hazardous substances in a safe manner. For example, in Hinode-cho, Tokyo, the local residents monitored water quality and detected heavy metals in

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[16] Ex Corporation, "Japan's experience in urban environmental management: Interim report" (Tokyo: December 1992).

[17] The Development Bank and The Financial Cooperation for Small & Medium Firms also provided low-interest loans.

[18] In 1992, the Japanese "Keidanren" (the Japanese Business Association), the Ministry of the Public Health, and the prefectural governments jointly set up a foundation to finance constructing and improving industrial waste treatment facilities. This project intends to provide low interest loans to small-scale industrial waste treatment subcontractors. This is another example of collaboration between private business and the government.

[19] Of the total 9,185 intermediate treatment facilities, 73% was ran by generators. Meanwhile, of the total 2,515 final disposal facilities, 68% was ran by subcontractors. Environment Agency, Kogai no jokyo ni kanshuru nenji hokoku (Environmental annual report), (Tokyo: 1992).

the river and ground water. They suspect that the rubber sheet of the controlled landfill in the area was torn and toxic substances leaked and contaminated the water.[29]

19. In addition, air and water pollution by noxious substances such as trichloroethylene and tetrachloroethylene are an increasing concern in Japan. These substances are used in various manufacturing industries and specifically by the electronics industry in large quantity. Although recovering systems of noxious substances have been developed, cost-effective adaptation of the system is difficult because of diversified and numerous small-scale users.

20. To respond to the acute situation of hazardous wastes and to prevent potential accidents in the process of toxic waste treatment and disposal, the government revised the Waste Disposal and Public Cleaning Law in October 1991. In the new regulation, explosives and infectious characteristics were added to the previous hazardous waste criteria. These newly defined hazardous and dangerous wastes are categorized as specially controlled municipal waste (PCB contained parts of household electric applicants, infectious waste, and slag from municipal waste incinerators) and specifically controlled industrial waste.

21. The government is also expected to assist in strengthening waste management business' technological capacities to deal with more complicated toxicities. Industries and waste management business needs assistance to increase recovery and recycle useable materials from wastes. Waste minimization efforts at source are also important; the waste generators need to reduce their waste by modifying their production process as well as by recycling materials.

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[29] Being aware of the potential danger of this type of problems, on behalf of the prefectural governments, the Environmental Agency is developing methodologies to identify sources of underground water contaminations and underground water monitoring (Asahi Newspaper, January 3, 1993, p.1).

Table 3A.1: Comparison of Effluent Quality Standards for Palm Oil Industry

Parameter	*MALAYSIA* (i) *Max. Discharge Limit*	*INDONESIA* (ii)	
		Maximum Concentration	*Maximum Pollution Load*
BOD (iii)	100 mg/l	250 mg/l	1.5 kg/ton
COD	--	500 mg/l	3.0 kg/ton
Total	400 mg/l	300 mg/l	1.8 kg/ton
Suspended	50 mg/l	30 mg/l	0.18 kg/ton
Solids	150 mg/l*	20 mg/l	0.12 kg/ton
Oil & Grease	200 mg/l*	--	--
NH_3 - N	5.0 - 9.0	6 - 9	--
Total N	--	--	6 m^3/ton of palm oil product
pH			
Flow (maximum)			

(1) Environmental Quality (Prescribed Premises) (Crude Palm Oil) Amendment, 1982.

(ii) Decree Number KEP-03/MENKLH/11/1991 - Re: Effluent Quality Standards for Existing Operations.

(iii) Malaysia - BOD_3 at 30°C
Indonesia - BOD_5 at 20°C

* Filtered samples.

Table 3A.2a: Summary of Common Pollutants Critical to Human Health

Pollutant	*Population at Risk*	*Health Impact*	*Exacerbating Factors*
Particulate Emissions	Entire population, especially motorists and pedestrians.	Increase in illness, cancer and death from respiratory illness and decrease in lung function.	Especially PM10, or if there are high concentrations of acid aerosols such as sulfate and nitrate particles.
SOx and NOx	Urban dwellers, commuters and factory workers.	Respiratory infection increased airway resistance, and decreased lung function.	Most significant effects in children and asthmatics.
High BOD (Biochemical Oxygen Demand)	Users of untreated public water supplies.	Gastro-intestinal illness.	Greatest impact through dehydration and diarrhea in young children.
Heavy Metals	Ingested through water supply or from exposed foods	Poisoning, increased child morbidity and mortality.	Populations on water courses close to mining at risk to mercury poisoning.

Table 3A.2: Comparison of Effluent Quality Standard for Rubber Industry

	MALAYSIA (1)		*INDONESIA* (2)	
Parameter	*SMR & Conventional Grade Factory (mg/l)*	*Latex Concentrate (mg/l)*	*Rubber Industry*	
			Maximum Concentration mg/l	*Maximum Pollution load (kg/ton)*
BOD (3)	100 (50*)	100 (50*)	150	6.0
COD	250	400	300	12.0
Suspended Solids	150 (100*)	150 (100*)	150	6.0
Total Nitrogen	60**	300	--	--
Ammoniacal Nitrogen	40**	300	10	0.4
pH (unit)	6 - 9	6 - 9	6 - 9	--
Flows (max.)	--	--	--	40 m^3/ton of rubber product

(3) Malaysia - BOD_3 at 30°C.
Indonesia - BOD_5 at 20°C.

* Arithmetic mean value based on a minimum of 4 samples taken at least once a week for four consecutive weeks.

** Filtered sample.

Source: (1) Environmental Quality (Prescribed Premises) (Raw Natural Rubber) (Amendment) Regulations 1980.

(2) Decree Number KEP-30/MENKLH/11/1991-Re - Effluent Quality Standards for Existing Operations.

Table 3A.3 : Unit Costs of Water Pollution Treatment in The Philippines
(Top 100 Polluting Firms in Manila)

Industrial subsector	*Average additional cost (US$/kg)*
Beverages	0.27
Laundries	0.29
Dyes & Textiles	0.35
Food processing	0.29
Tanneries	0.19
Metal working	0.53
Chemicals	0.30
Pharmaceuticals	0.60
Pulp & Paper	0.90
Slaughterhouses	0.18
Electronics	NA
Average	0.26

Source: Based on World Bank IEPC Study, August 1992

Table 3A.4: Malaysia: Number of EIA Reports Received and Being Reviewed by the Department of Environment, 1988-1991

No.	*Activity*[a]	*Number and Type of Reports Received*				*Total*
		1988	1989	1990	1991	
1	Agriculture	0	1	0	3	4
2	Airport	0	0	0	0	0
3	Drainage & Irrigation	1	1	0	3	5
4	Land Reclamation	0	3	3	3	9
5	Fisheries	0	0	0	1	1
6	Forestry	0	0	2	9	11
7	Housing	1	3	9	22	35
8	Industry	1	9	16	22	48
9	Infrastructure	0	1	17	38	56
10	Port	0	1	2	0	3
11	Mining	1	1	7	1	10
12	Petroleum	4	5	14	10	33
13	Power Generation &	2	3	1	5	11
14	Transmission	0	3	13	17	33
15	Quarry	0	0	1	0	1
16	Railway	0	0	0	0	0
17	Transportation	0	0	15	34	49
18	Resort & Recreational	1	3	10	1	15
19	Development	0	1	3	2	6
	Waste Treatment & Disposal		0	0	0	0
20	Waste Supply	0	1	0	3	4
	Exclusive Economic[b] Zone					
	Total	11	36	113	174	334

[a] Activities according to EIA Orders
[b] Petroleum Development Projects in the Exclusive Economic Zone (Section 21(1) and 22(1) EEZ Act, 1984)

Source: Environmental Quality Report, 1991 (DOE, 1992).

Table 3A.5: Hazardous Waste: Environmental Risk Factors and Costs
(Malaysia 1987)

Hazardous Waste Type	Waste *Tons*[a]	Relative Risk *Factor*[b]	Exposed Population *Million*[c]	Envir. Risk *Factor*[d]	Cost of Treatment *per ton(RM)*[e]	Risk Reduction *(Per RM)*
Oils	7,026	1	17	120	64	1.875
Liquid organic residues-NH	1,759	1	13	20	58	0.3
Liquid organic residues-H	173	1000	9	1,560	834	1.8
Organic sludges-NH	335	1	14.5	10	58	0.17
Organic solids-NH	1,329	1	7	10	834	0.01
Organic sludges and solids-H	90	1000	10	900	834	1.08
Inorganic sludges and solids	16,773	1	12	200	15	13
Heavy metal sludges and solids	19,912	1000	10	1,991,10	16	12444.3
Solvents-H	239	100	10	240	198	1.2
Solvents-NH	873	10	17	150	320	0.47
Acid wastes	29,361	100	12	35,200	26	1353.8
Alkaline wastes	9,452	100	13	12,300	8	1537.5
Resin and glue	164	100	8	130	291	0.45
PCB		10000				
Aqueous organic residues	10,250	100	11	11,300	15	753
Photo Wastes	4,228	100	10	4,200	5	840

Source: This table is constructed based on Table 6.1, in Phann Kritiporn, Theodore Panayotou, and Krerkpong Charnprateep, The Greening of Thai Industry: Producing More and Polluting Less (Bangkok: Thailand Development Research Institute, 1990) p.104 and Table 3.4 (by converted volume to weight) in the main text.

H and NH: Halogenated Non halogenated

[a]. Projected quantities for 1987, Dames & Moore

[b]. Order of risk; for example, PCB imposes 1,000 times as much risk as do Oils

[c]. December 1988 population in provinces where specific waste type is being generated

[d]. Waste quantity x relative risk factor x exposed population/1,000 rounded off to nearest 1,000.

[e]. Cost estimation in Thailand was applied. 2.5 Ringgit = 1US$.

IV. ROAD TRANSPORT

A. Introduction

4.1 The rapidly increasing number and concentration of transport vehicles result in air pollution and congestion especially in urban areas. As argued in Chapter II, lead pollution is a serious problem. Hydrocarbons and nitrogen oxides, are also on the increase leading to the frequent incidence of the haze. Increasing volume of traffic in the urban areas has contributed to the opportunity cost of time lost due to congestion. Unattended, these problems will become far worse in years ahead imposing high costs on the economy.

4.2 Exhaust emissions from diesel and gasoline engines in road transport result, even after controls, in higher pollution than emissions from energy consumption in furnaces and turbines (see Table 4.1). Motor vehicles produce additional emissions from engine crankcases and the evaporation of fuel. For example, 55 percent of hydrocarbon emissions originate from the exhaust, 20 to 30 percent from evaporation and 25 percent from crankcases.

4.3 At four people per vehicle, ownership in Malaysia in 1988 was higher than in Thailand (11), Indonesia (22), the Philippines (47), Hong Kong (17), and even slightly higher than in Singapore (5). The total vehicle fleet in Malaysia doubled over the 1980s to an estimated 3.5 million in 1991, substantially raising the emission of pollutants. The Department of the Environment estimates that vehicles account for 94 percent of carbon monoxide emissions, 44 percent of hydrocarbons, 40 percent of nitrogen oxide emissions, and nearly all of lead. This report estimates that if present trends continue, the size of the fleet would increase two and a half times in the next two decades and emissions would triple. This will take a heavy toll on the economy.

4.4 As discussed in Chapter II the health costs of total suspended particulate and lead concentrations are substantial, for the existing population and work force and for future generations. Lead, in particular, affects the development of intelligence in children. Concentrations of carbon monoxide in selected areas and the impact of hydrocarbons and nitrogen oxide on ozone levels would result in additional costs.

4.5 The cost to the economy of time lost due to traffic congestion is by no means trivial. Regular visitors to Malaysia have noted the rapid increase in travel time in the past five years within the Klang Valley, but especially between the Kuala Lumpur city center and Subang airport. It is conservatively estimated that congestion has added fifteen minutes to the average daily journey time, which in the absence of a major policy shift would more than double to thirty five minutes by the year 2000.

4.6 Health and congestion costs associated with transport emissions are expected to increase as economic development proceeds. This is in part due to increased demand for private transport as private incomes grow, but also because Malaysian manufacturing is very transport intensive; most inputs are imported and most of output is exported. Furthermore, industrial location policy

has resulted in an increase in corridors of concentrated vehicular traffic, where the pollution and congestion problems are serious.

4.7 This chapter identifies the problems of transport-related pollution in Malaysia and recommends cost-effective policies for their solution. The discussion is limited to road traffic because that is the predominant transport mode in Malaysia: 95 percent of passenger traffic and 91 percent of freight traffic in 1990 was on roads. Furthermore, due to the scarcity of national transport-related data, the more detailed analysis is limited to the Klang Valley, which includes the capital Kuala Lumpur (KL) and part of the surrounding state of Selangor.

4.8 The discussion is organized as follows. Part B analyses the vehicle fleet in Malaysia, its energy consumption, and its contribution to air pollution; congestions costs are also estimated. In Part C, a scenario is developed to show the future contribution of the transport sector to air pollution, assuming no major changes in policy. Part D gives an overview of the direct policy interventions in Malaysia that have an impact on the environmental performance of the transport sector. Costs of selected abatement measures are estimated. Part D also presents additional cost-effective policies, including simulations for fuel pricing options and for transport pollution abatement, drawn from the experience of other countries. Part E presents the main conclusions and recommends a three-pronged strategy of short, medium, and long-term measures for transport pollution abatement.

Table 4.1: Emission Characteristics of Combustion Technologies
(emissions in g/kg fuel)

Pollutant	*CO*	*VOC*	*NOx*	*SPM*
Oil-fired furnace	0.6	0.1	9	0.1
Oil-fired gas turbine	1.5	2.7	1.2	<0.1
Diesel engine				
- Uncontrolled	20	5	70	3
- Controlled	5	3	30	0.4
Gasoline engine				
- Non-catalyst	250	30	60	<0.3
- Catalyst	25	2	6	<0.1

CO = Carbon monoxide; VOC = volatile organic compounds; NOx = nitrogen dioxide and nitric oxide; SPM = suspended particulate matter.

Source: Faiz et al, 1992, Table 3.1.

B. Vehicle Fleet, Energy Consumption, Pollution and Congestion

4.9 The environmental impact of transportation stems from its energy consumption and depends on several factors: number of vehicles, composition by mode, activity level and operating conditions (engine and fuel type, occupancy, age and maintenance, speed and congestion). These are discussed first to lead into an analysis of transport-related emissions in Malaysia. Traffic congestion costs are also estimated.

The Fleet

4.10 Most road traffic is dedicated to moving of people: 92.5 percent of all registered vehicles are passenger vehicles. The overwhelming majority of these are for private transportation: private cars and motorcycles comprise 96 percent of registered fleet. In terms of passenger-kilometer, their share goes down to 68 percent, since their occupancy is lower than that of public transport vehicles. Like many Asian countries, Malaysia has a huge motorcycle fleet: about 55 percent of all vehicles are motorcycles (see Table 4.2).[1/]

4.11 Information on the operating vehicle fleet is currently sketchy but is expected to improve with ongoing computerization of registration. The Road Transport Department (RTD) estimates that only about 60 percent of all registered vehicles are actually operating.[2/] Between 1980 and 1991, the operational fleet in (Peninsular) Malaysia has more than doubled from 1.6 to 3.5 million vehicles. The average annual growth rate of the vehicle fleet in the 1980s was around 7 percent and thus higher than the 5.9 percent growth rate of real GDP. Strikingly, between 1985-91, the annual growth rate of the vehicle fleet in Kuala Lumpur, at 10.5 percent, was almost twice the national average.

4.12 Compared to other Asian countries, the number of vehicles per capita is quite high with 247 vehicles per 1,000 inhabitants in 1988, compared to 60 in Hong Kong, 92 in Thailand, 187 in Singapore, and 578 in Japan.[3/] These numbers include motorcycles, which are a major source of traffic related pollution because the technology involves two-stroke engines. Excluding motorcycles, the number of vehicles owned per 1000 persons in Malaysia is 101 which is twice the level in Thailand (47) and Hong Kong (57).

4.13 Age distribution of the fleet and vehicle maintenance are major factors influencing environmental performance. On average, vehicles in developing countries are older and less well maintained than in developed countries,

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[1/] For an analysis of the freight vehicle fleet see World Bank, 1988.

[2/] The difference is so large because the registration does not account for exits from the fleet.

[3/] Source: Faiz, 1992, Statistical Annex A. This kind of comparison is inherently difficult because of possible differences in the definition of the vehicle fleet from country to country. For example, the size of the Malaysian vehicle fleet reported in the source is approximately the size of the registered fleet. But this is an overestimate of the operating fleet.

Table 4.2: Registered Vehicles, Total Malaysia and Klang Valley 1991

	MALAYSIA		Kuala Lumpur and Selangor		
	(thousands)	Percent	(thousands)	Percent	Percent of Malaysia
Private cars	1971	33.5	671	42.5	34.0
Gasoline	1906	96.7	653	97.3	34.3
Diesel	65	3.3	18	2.7	27.5
Motorcycles	3251	55.2	689	43.7	21.2
Taxis and hire cars	38	0.7	15	0.9	38.7
Gasoline	17	43.4	9	59.7	53.2
Diesel	22	56.5	6	40.3	27.5
Buses	28	0.5	8	0.5	30.3
Gasoline	2	5.6	1	6.0	32.2
Diesel	26	94.3	8	93.9	30.2
Vans and lorries	411	6.9	124	7.8	30.1
Gasoline	165	40.2	66	53.4	40.0
Diesel	246	59.8	58	46.6	23.4
Trailers	28	0.5	9	0.6	33.4
Others	160	2.7	61	3.9	38.3
Gasoline	17	10.5	8	13.5	49.3
Diesel	143	89.5	53	86.4	37.0
TOTAL	5887	100.0	1578	100.00	26.8
Total passenger	5448	92.5	1445	91.6	26.5
Total freight	439	7.5	133	8.4	30.3
Total gasoline	5384	91.5	1435	90.9	26.6
Total diesel	502	8.5	142	9.0	28.3

Source: Ministry of Transport, Road Transport Department.

contributing to more pollution.[4] On the other hand, higher growth rates and rapidly rising income in Malaysia lead to a faster turnover of the fleet than in countries such as the United States.[5] Unfortunately, information on the age distribution is scant, consisting of a survey of Kuala Lumpur/Petaling Jaya

[4] See Faiz et al, 1992, Chapter 8.

[5] For example, in Japan only 8.4 percent of the fleet are more than 10 years old, while in the United States the share is 30 percent. This is not only due to higher growth rates but also to the structure of fees and insurance (see Krupnik, 1992).

service stations (REDP, 1989), which covers part of the Klang Valley. It reports that the roughly 70,000 gasoline vehicles surveyed have an average age of 6.4 years, which is slightly higher than the average age of 5.6 years of the 3,800 diesel vehicles surveyed. It is remarkable that buses account for half the diesel vehicles less than three years old.

4.14 Road infrastructure has improved considerably in recent years. The road network increased from 43,415 km in 1985 to 63,445 km in 1990, an average annual increase of 7.9 percent. Road construction was concentrated in the Klang Valley, with Kuala Lumpur and Selangor increasing their share in the national road network from 9 percent in 1985 to 15 percent in 1990. But even though annual growth rates in road construction were 20 percent in Selangor and 25 percent in Kuala Lumpur, this did not significantly alleviate urban congestion problems. Vehicle concentration in this area is much higher than nationwide: while each (registered) vehicle in Peninsular Malaysia has about 12 meters of road space, this is reduced to 9 meters in Selangor and 2 meters in Kuala Lumpur (1990).

Energy Consumption

4.15 Information on energy consumption by the transport sector is comparatively good. Transport's share in final energy consumption was 41 percent in 1990, compared to 38 percent in 1980.[g] Most of this was accounted for by road transport (see Table 4.3). Diesel vehicles consume 44 percent of total fuel even though they comprise only 8.5 percent of all registered road vehicles. This is because most high-use vehicles like taxis, buses and trucks are diesel vehicles. They continue to use diesel because of the low price for diesel fuel, which is only 58 percent of the gasoline price. This results in lower total cost for high-use diesel vehicles than for high-use gasoline vehicles, taking into account all costs such as purchase, fuel, taxes and fees (see Part D).

4.16 Specific vehicle fuel consumption is an indicator of efficiency in energy use. The 1989 REDP survey results are shown in Table 4.4, which also gives the fuel consumption used in the JICA KVAQ report (1992), by DOE, and in the INEP study. Except for motorcycles, the JICA values are uniformly and considerably higher. If the fuel economy of the latest model PROTON (CARES) of 10 liters/100 kilometers in urban areas is taken as a comparator, the JICA estimates seem to be closer to reality for the average fleet. In international comparison, average specific fuel consumption in Malaysia is relatively high. It is interesting to note that the countries with low average fuel consumption, such as Japan, tend to have high gasoline prices (see Table 4.10).

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[g] This is likely to be an underestimation. Part of the diesel fuel that is sold to the industrial sector is used for transportation, but not allocated to the transport sector.

Table 4.3: Energy Consumption in the Transport Sector
(KTOE)

	1980	*1985*	*1990*	*1991*
Road transport	2044	3261	4647	NA
Gasoline	1221	1965	2691	3123
Diesel	823	1296	1956	NA
Rail; Diesel	27	27	26	NA
Air; Aviation fuel and gas	317	415	557	690
Ship; Diesel	13	16	20	NA
Total diesel	863	1339	2001	1993
Total transport	2401	3719	5249	5806
Percentage of road transport	85	87	88	NA
Total energy use[a]	6093	8080	12299	14477
Percentage of total energy Use	39	46	42	40

[a] INEP data exclude non-energy use.

Source: 1980-90: Integrated National Energy Plan; 1991.

Air Pollution From Transport

4.17 The Department of the Environment estimates[7/] that in 1991 vehicles (mobile sources) account for 94 percent of carbon monoxide emissions, 44 percent of hydrocarbons, 40 percent of nitrogen oxides, 6 percent of

[7/] DOE keeps an emission inventory, which in its current state is rather preliminary. For each vehicle class the annual activity level (passenger or freight kilometers per vehicle) is estimated and multiplied by the number of operating vehicles in that class. These data multiplied by specific fuel consumption for each class yield the annual fuel consumption. This is then multiplied with the emission factors (kg of pollutant per 1,000t of fuel consumption) to give the estimated annual emission of each pollutant for each vehicle type. The estimates are highly approximate for a number of reasons: information on activity levels and specific fuel consumption is not yet collected on a regular basis; the emission factors are those used by USEPA, which are not representative of Malaysian circumstances. The JICA KVAQ study will ultimately provide the information necessary to establish more appropriate emission factors as well as better knowledge about operating conditions in Malaysia.

Table 4.4: Specific Vehicle Fuel Consumption, Klang Valley
(in liters/100 kilometers)

	A	*B*	*C*	*D*
Motorcycle, G	4.1	4.0	4.9	4.0
Motor car, G	7.6	11.0	10.0	9.0
Diesel	7.8	-	6.7	9.0
Taxi, G	7.3	11.0	10.0	9.0
Diesel	6.9	10.0	6.7	9.0
Van, G	7.9	11.0		
Diesel	8.3	10.0		
Mini bus, D	7.0	23.0		
Bus, D	12.1	50.0	13.3	
Small truck, G		13.0		
Med. truck, D		23.0		
Large truck, D		50.0		
Lorry/trailer, D		50.0	13.3	

G: Gasoline, D: Diesel.

Source: (A) Regional Energy Development Program 1989, (B) Japan International Cooperation Agency 1992 (Pre-1990 Models), (C) Department of the Environment, (D) Integrated National Energy Plan.

particulate matter, and 6 percent of sulphur monoxide.[9] Except for nitrogen oxides and sulphur oxides, the shares of traffic-caused pollutants decreased slightly compared to 1990. The DOE does not estimate lead emissions, but the transport sector typically accounts for almost all of the lead emissions (95 percent are assumed here). Lead emissions can easily be inferred, because they are directly proportional to fuel consumption and the concentration of lead in it. Thus, gasoline-fueled cars account for more than 50 percent of lead emissions (see also Figure 4.2).

4.18 Table 4.5 shows that overall the most polluting sector in Malaysia is the transport sector with about 71 percent of the total pollutant load (including lead) in 1991, down from 74 percent in 1990. But not all pollutants are equally toxic. Using a pollutant index that weighs pollutants according to

[9] The results of the JICA 1992 study indicate that the contribution of the transport sector to nitrogen oxides (72%) and particulate emissions (23 percent) may have been underestimated by DOE.

their toxicity,[2] the contribution of the transport sector in 1991 drops to 35 percent (based on a lead content of 0.15g/l).

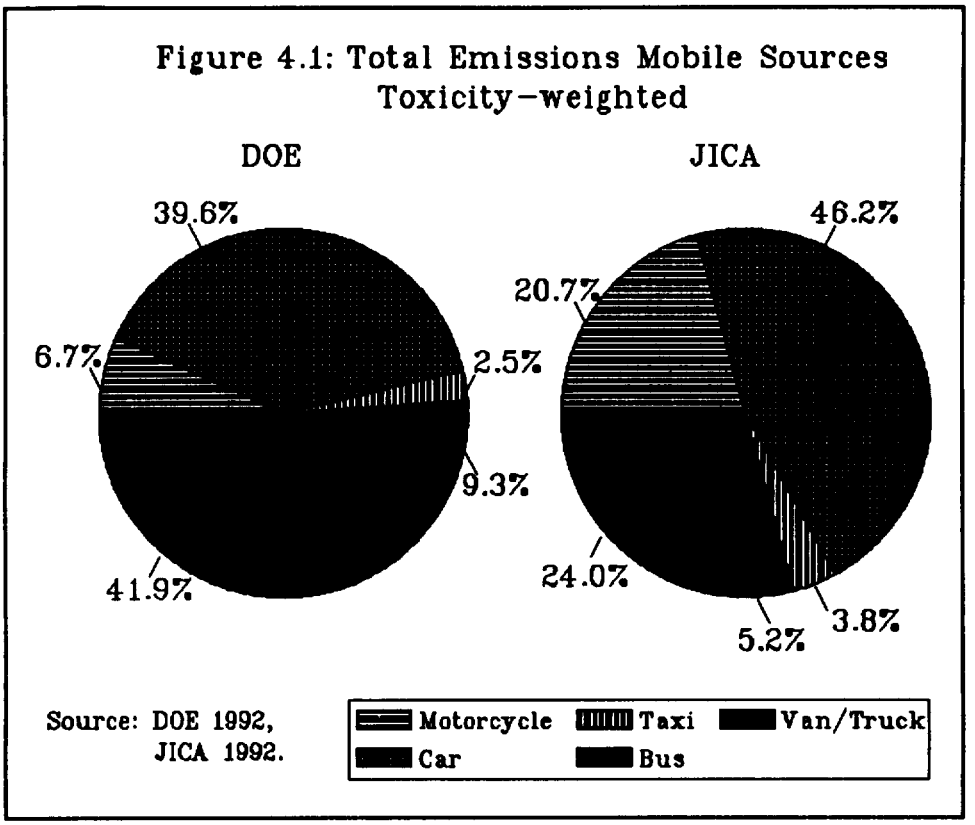
4.19 The growth in the vehicle fleet was the main factor contributing to the increase in emissions stemming from mobile sources from a total of 571,000 MT (unweighted) in 1987 to 681,000 MT in 1991. Mobile sources are basically uncontrolled in terms of emissions (except for black smoke emissions of diesel vehicles; see Part D). Power stations and industrial sources, on the other hand, are required to install pollution abatement equipment or switch to cleaner fuels. They have managed to reduce their overall emissions, especially of sulphur oxides.

Table 4.5: Emissions From the Transport Sector, 1991

In '000 T	*Lead*	*Particu-lates*	*Sulphur-oxide*	*Nitrogen-oxide*	*Hydrocarbon*	*Carbon-monoxide*	*SUM*
Unweighted							
(1) Total	0.62	62.38	75.26	118.65	68.81	635.94	961.66
(2) Mobile Sources	0.59	3.60	4.40	47.20	30.30	595.50	681.59
(3) (2)As percentage of(1)	95.24	5.77	5.85	39.78	44.03	93.64	70.88
Weighted							
Pollutant Index	85.00	3.20	1.40	4.70	1.80	0.04	96.14
(4) Total	52.81	199.62	105.36	557.66	123.86	25.44	1064.74
(5) Mobile sources	50.29	11.52	6.16	221.84	54.54	23.82	368.17
(6) (5)As percentage of(4)	95.24	5.77	5.85	39.78	44.03	93.64	34.58

Source: DOE 1991, 1992.

[2] The index was developed for the World Bank Mexico City Report 1992. The weights are reported in the second part of Table 3.4.



4.20 For the design of an effective transport policy, it is important to identify pollutant loads by vehicle type. Figure 4.1 shows the contribution of various vehicle types to total emissions (toxicity-weighted, including lead) as reported by DOE and JICA, respectively. Among the many discrepancies, the major difference between the two studies concerns the emission shares of motorcycles. While motorcycles are responsible for 21 percent of all emissions according to JICA, the DOE estimate is only 7 percent, indicating a severe underestimation. The figure also shows that, according to JICA, private cars contribute as much to emissions as motorcycles and trucks together, and that the share of bus and taxi emissions in total emissions of around 10 percent is fairly minor. A more detailed breakdown of the contribution of the various vehicle types to the emissions of particular pollutants, using the JICA results, is reported in Figure 4.2.

4.21 In contrast to other big cities, high-use commercial vehicles do not seem to be the main culprits of traffic-caused air pollution in the Klang Valley. In the Klang Valley, taxis, buses and trucks are responsible for only 33 percent of emissions compared to, for example, 62 percent in Mexico City. Explanations for this difference are (i) that in Klang Valley, private vehicles (cars and motorcycles) have a very high share not only in terms of registration (87 percent in Klang Valley, 90 percent in Mexico City), but also in vehicle-kilometers (75 percent in Klang Valley, 34 percent in Mexico City), and (b) possibly better

operating conditions of high-use vehicles in Kuala Lumpur. Put differently, public transport is not a heavily used mode in Malaysia,[10] and it may also be somewhat better regulated than in other countries (more on this later).

4.22 A comparatively large share of motorcycle emissions is generated by two-stroke engines, which are only about half as fuel efficient as four-stroke engines and emit about 10-15 times as much hydrocarbon. Unfortunately, hard information is not available on the share of two-stroke engines in the total motorcycle population in Malaysia, but an "informed guess" puts it at about 50 percent.[11] This compares to a share of about 95 percent in Thailand.

4.23 A time pattern for the ambient concentration of pollutants has been established for Kuala Lumpur.[12] The concentrations of all monitored pollutants show two daily peaks. The morning peaks have been found to be highly correlated with traffic density during rush hour, and are exacerbated by meteorological conditions such as low mixing height and reduced wind velocity.

Congestion

4.24 The deterioration in air quality is worsened by congestion for two reasons[13]: (a) emissions during acceleration and deceleration associated with stop-and-go conditions on congested roads tend to be several times higher than at constant speed; and (b) congestion reduces travel speed, which in itself increases emissions since most vehicle emissions (except nitrogen oxides) typically decrease with speed.

4.25 Congestion also imposes significant time costs because of delays due to traffic jams. For example in Bangkok, the daily social costs due to traffic jams in 1989 have been estimated[14] at between US$1.8 million and US$4.35 million.

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[10] In an inter-Asian comparison, the relatively low share of public transport in Malaysia (in terms of motorized trips) is confirmed. The "Urban Transport in Asia" World Bank report (1991) lists only Nagoya and Greater Tokyo in Japan, Kanpur (India), and Surabaya (Indonesia) with public transit shares below the 38 percent share in Kuala Lumpur.

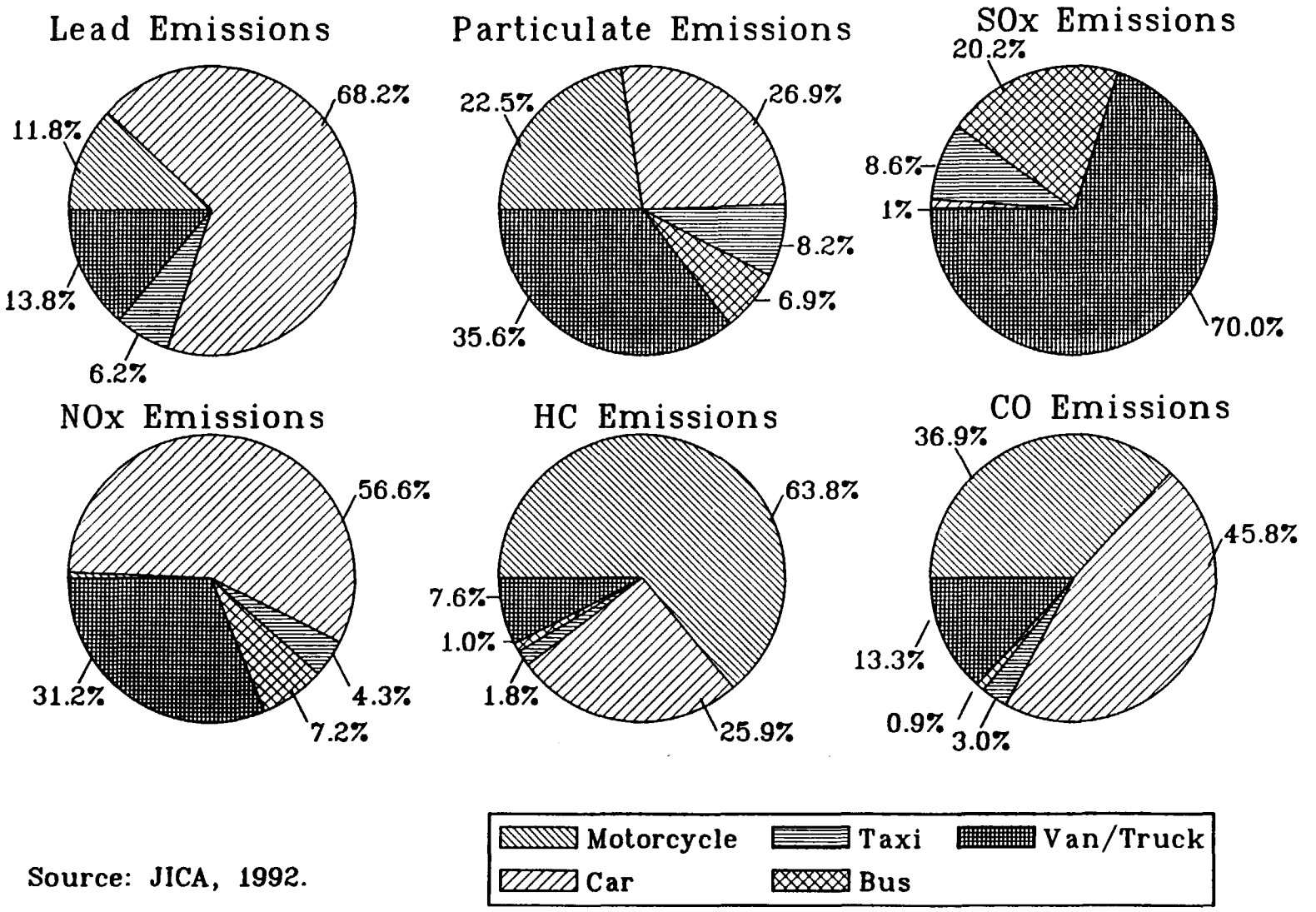
[11] JICA assumes 100 percent two-stroke engines.

[12] See Awang, 1992.

[13] See Faiz et al, 1992.

[14] Shin et al, 1992.

Figure 4.2: Breakdown of Pollutant Emissions Among Different Mobile Sources



Source: JICA, 1992.

4.26 The benefits of reduction in traffic congestion would accrue from many of the policy recommendations for reducing demand for travel to check transport related pollution. With this in mind, an attempt is made below to assess the cost of increased congestion. The estimates presented in Table 4.6 are preliminary and are based on interviews in Kuala Lumpur to assess how much longer it took in end-1992 to travel within Kuala Lumpur compared to five years ago. A proper analysis should allow for differences in speed at various points of urban road network. Although this was not explicitly carried out, it is implicit in the simple approach taken here. In Table 4.6, a preliminary estimate is made of the opportunity cost of travel time lost due to traffic jams in Kuala Lumpur in 1992 and in the year 2000. It is estimated that the cost of time lost in traffic delays in 1992 was RM 1 billion. Unless remedial action is taken this will increase to a staggering RM 13 billion in the year 2000. The assumptions underlying these calculations are stated in the Table. It is likely that fewer double occupancy vehicles are on the road in 1992 than is being assumed. However, this is counteracted by the following: (a) the average number of occupants is probably greater than two because public transport vehicles have much higher occupancy; and (b) average time lost in traffic jams is argued by many to be closer to thirty minutes or twice that assumed in Table 4.6.

4.27 In projecting costs to the year 2000, two assumptions are modified. First, it is being assumed (a la Lankhorst et al, 1990) that by the year 2000 Kuala Lumpur traffic will increase to 3.5 million vehicles per day, while the road network in the Federal Territory will expand from 1,003 to 1,375 km; this will lead to an increase in traffic concentration from 57 to 132 vehicles per kilometer per direction. If time spent in traffic jams increases linearly with concentration, time lost in traffic jams will be thirty five minutes per day. And second, it is assumed that real wage will double to RM 12 in the year 2000, a modest increment indeed, given the economy's optimistic growth prospects.

Table 4.6: Cost Estimates of Travel Time Lost Due To Congestion in Kuala Lumpur

	Congestion Cost 1992	*Congestion Cost 2000*
	Assumptions	*Assumptions*
1. Vehicles on KL roads per day	1.15 million	3.5 million
2. Hourly wage	RM 6.75	RM 12
3. Occupants per vehicle	2	2
4. Average daily time lost in traffic jams	15 minutes	35 minutes
5. Yearly working days	275	275
Total annual congestion cost	RM 1.07 billion (= US$427 million)	RM 13.4 billion (=US$5.4 billion)

Source: Lankhorst et al, 1990; and Bank Staff estimates.

C. Forecast of Vehicle Fleet, Energy Consumption and Emissions

4.28 Robust average economic growth of 7 percent a year is an avowed target of Malaysian policymakers as stated in "Vision 2020." This will impact on the growth of the vehicle fleet and on air pollution. Based on a methodology presented in Appendix IV.1, Table 4.7 presents projections of fuel consumption and pollution for Malaysia up to the year 2020. This scenario will be referred to as "BAU" (business as usual). The main findings are:

(a) In the period 1990 to 2020, passenger traffic is forecasted to increase 257 percent and freight traffic 287 percent, leading to a cumulative growth of 215 percent in fuel consumption (at 3.9 percent a year). In the absence of a major policy shift, this will result in an increase of total emissions of 3.6 percent and 3.9 percent a year on an unweighted and on a toxicity-weighted base, respectively. Emissions from the transport sector would thus roughly triple in the thirty-year period. Especially in urban areas, this would result in a rise in atmospheric concentrations of these pollutants, in many cases probably surpassing the current standards and guidelines.

Table 4.7: Fuel Consumption and Pollutant Load in the Transport Sector, 1990-2000
(In '000 T)

	Fuel Consumption	*Lead*	*Part*	*Sulphur-oxides*	*Nitrogen-oxides*	*Hydro-carbon*	*Carbon-monoxide*	*SUM*
Unweighted								
1990	4732	0.56	5.01	3.23	43.29	28.01	551.36	631.46
2000	7394	0.62	7.77	5.16	69.53	43.36	837.96	964.39
2010	10688	0.89	11.18	7.81	105.62	61.66	1164.53	1351.69
2020	14890	1.24	15.37	11.01	148.38	84.97	1562.59	1823.56
Weighted								
Pollutant Index		85.00	3.20	1.40	4.70	1.80	0.04	96.14
1990		47.90	16.03	4.52	203.46	50.42	22.05	344.39
2000		52.39	24.86	7.22	326.78	78.05	33.52	522.81
2010		75.72	35.79	10.93	496.42	110.98	46.58	776.43
2020		105.50	49.17	15.42	697.40	152.94	62.50	1082.93

Source: World Bank Calculations with INEP Fuel Consumption and DOE Emission Factors, see Appendix IV.1.

(b) The reduction in lead emissions due to the reduction in lead content and the introduction of unleaded gasoline will be a transitory phenomenon if no measures are enacted to increase the market share of unleaded gasoline beyond the current 30 percent. The increase in fuel consumption will cause lead emissions to reach their 1990 level again in 1998, assuming that the market share of unleaded gas will remain constant at 30 percent.

4.29 The findings reported above are corroborated by two studies. The MIER study[15] estimates all of the above pollutant concentrations (except lead) generated by all sectors of the economy. According to MIER, the concentrations of particulates, sulphur oxide, nitrogen oxides and hydrocarbons will all exceed U.S. EPA standards by 1999. Ambient carbon monoxide concentrations on the other hand will remain within the USEPA prescribed standard and not pose a problem.

4.30 The Lankhorst study[16] estimates TSP and CO concentrations in the years 1990 and 2000 in KL, for the CPA (Central Planning Area) as well as for Kuala Lumpur as a whole (WPKL). The reported 1990 total suspended particulate concentrations are above the guideline of 150ug/ccm in the CPA (192ug/ccm) and close to it in WPKL (135ug/ccm). Ten years on, they are expected to reach concentrations of 240 ug/ccm in the CPA and 190 ug/ccm in WPKL. Regarding CO, in both the CPA and WPKL, current ambient carbon monoxide levels are below the guideline of 9ppm; but in the year 2000, the carbon monoxide level of 9.66 in the CPA would exceed the guideline.

4.31 The geographically more limited Lankhorst study thus shows that critical pollutant concentrations may already have been reached locally and that a concerted policy action is necessary to avoid serious health and environmental problems.

D. Policies For Transport Pollution Abatement

4.32 International experience suggests that a broad range of policies exist to deal with the environmental impact of the transport sector. Up to now, the transport sector in Malaysia has been virtually unregulated with respect to environmental aspects. The few exceptions are standards with respect to lead content of gasoline and black smoke emissions and policies on fuel switching. However, most transport-related policies have environmental impacts, although these are usually not intended. Among the most important indirect policies are those that influence the costs of various transport modes, such as fuel prices, vehicle prices, and licensing conditions of public transport vehicles, as well as the provision of transport infrastructure.

4.33 The policy analysis in the first section of this part discusses the three direct interventions in Malaysia in their current mode and presents a cost estimate for each. The second section draws upon the international experience, and builds on Malaysia's own recent efforts, to recommend more comprehensive direct and indirect interventions for pollution abatement. Where data permit, an analysis of the cost effectiveness of measures is presented.

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[15] See Chiang, 1990.

[16] Lankhorst, 1990.

Direct Interventions Currently in Place

Emission Standards for Black Smoke Emissions from Diesel Engine Vehicles (Motor Vehicles (Control of Smoke and Gas Emission) Rules 1977)

4.34 Exhaust plumes from well-maintained diesel engines should be invisible. When the engine is not properly tuned, visible smoke is emitted containing excessive soot component of diesel particulate matter. Heavy duty diesel vehicles are particularly prone to this. Emissions standards in Malaysia limit black smoke emissions to 50 Hartridge Smoke Units (HSU). This standard is the same as in Singapore, but slightly stricter than in some other countries, e.g., Hongkong (60 HSU), Philippines (67 HSU), and India (65 HSU).

4.35 In order to enforce the emission standard, Department of the Environment, the Road Transport Department and the traffic police jointly conduct random roadside inspections. During an average of 450 campaigns annually about 40000 vehicles are stopped. The share of the registered diesel fleet being tested decreased from about 14 percent in 1989 to 11 percent in 1991. According to information in the EQR 1991, compliance has dropped from 83 percent in 1989 to 81 percent in 1990 and 77 percent in 1991. The compliance of commercial vehicles (especially lorries) is generally better than that of private cars. This may be due to the fact that the former have to be inspected every six months (see para. 53) and that private diesel vehicles are on average slightly older than commercial vehicles. If a vehicle fails the test, the owner must pay a fine of RM 500 (for the first summons) and repair the vehicle.

Reduction in the Lead Content of Gasoline and Introduction of Unleaded Gasoline (Environmental Quality (Control of Lead Concentration in Motor Gasoline) Regulation, 1985)

4.36 Given the injurious consequences for human health, reduction of atmospheric lead concentrating has become a top priority in Malaysia. Starting in 1986, the lead content in gasoline has been gradually reduced. At 0.15g it is now as low as in most OECD countries.[17] Unleaded gasoline was introduced in September 1991 and about 50 percent of it is imported. With the current blending process, the production cost of unleaded gasoline is RM 0.05 higher than that of leaded gasoline,[18] but the retail price is the same, presently RM 1.13 per liter. The government bears the cost of the subsidy by forgoing part of the duty on unleaded gasoline. This policy was intended to provide an incentive for motorists to use unleaded gasoline, but the result was not to the government's satisfaction, since unleaded gas has reached a market share of only about 30 percent in 1992; it even seems to have declined slightly in recent months. The government subsidy for unleaded gasoline was about RM 65 million in 1992. Both measures have helped in reducing lead emissions (see Figure 1.2) and in cutting atmospheric lead concentrations.

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[17] Thailand introduced the lead content limit of 0.15 g/l in mid-1992.

[18] The addition of MTBE would further increase production cost.

4.37 DOE monitors the compliance with the limit of lead content through analyzing samples obtained from manufacturers and suppliers. In 1991 all samples met the new, reduced lead content level of 0.15g/l.

Introduction of Alternative Fuels

4.38 As part of the fuel diversification program, natural gas use is promoted not only in the power and the industrial sector, but also in the transport sector. Compressed natural gas is more environment-friendly than either gasoline or diesel, but less user-friendly. The national oil and gas company PETRONAS embarked on a pilot program in 1986-88 to promote the use of natural gas vehicles (NGVs), which are now being introduced on a wider basis. So far, more than 80 percent of the 400 converted vehicles are taxis. The goal of the program is to convert 1,100 gasoline vehicles to bi-fueled natural gas/gasoline vehicles by the end of 1993. Currently, the program is restricted to the Klang Valley and Miri in Sarawak, but with the completion of the PGU II gas transmission and distribution project it will be implemented in other parts of the Peninsula as well. The program will also be extended to diesel vehicles, and mono-fueled engines and monogas buses will be introduced.

4.39 PETRONAS is actively involved in the natural gas vehicle program: the company is responsible for the infrastructure, arranges cheap loans for the conversion of vehicles (conversion cost of about RM 2300), and organizes training programs for installers, mechanics. The program is implicitly subsidized by the government through exemptions from import and excise duties. The retail price of fuel for natural gas vehicles has been set at half the price of premium gasoline (RM 0.614/l on an equivalent energy basis). According to PETRONAS, this price about covers its cost. The government has also exempted natural gas vehicles conversion kits from import duty and sales tax.

Cost of Current Direct Policies

4.40 The cost of current direct policies for transport pollution abatement is estimated in Table 4.8. The policies explicitly treated are: black smoke inspection of commercial vehicles and enforcement campaigns, lead policies, natural gas vehicles promotion, and the program in Kuala Lumpur to restrict taxi licenses to gasoline-fueled cars. Detailed data are not always available for Malaysia, so that cost estimates from other countries had to be adapted (see Appendix IV.2). The affected parties considered in the analysis are the government, the producers, and consumers (vehicle owners).

4.41 The total cost of transport pollution abatement policies is estimated at RM 190 million per year, which is borne largely by the government; in other words, the taxpayer. The government costs arise mainly in the form of subsidizing environmentally more benign transport fuels. PETRONAS also bears some of the cost of promoting NGV, while consumers, that is, taxi companies that convert their vehicles to NGV, are actively benefitting from this program. On the other hand, taxi companies/drivers in Kuala Lumpur bear the cost of abolishing the dirtier diesel taxis.

4.42 The cost estimates of black smoke enforcement and inspection show that government costs are relatively low. Commercial vehicle owners bear most of the costs of this policy in the form of fines and repairs. But in general, the polluter-pays principle has not yet been implemented in the transport sector.

Table 4.8: Cost of Current Environmental Policies in the Transport Sector
(1992, million RM)

	Government	*Producers*	*Consumers*	*Total*
Black Smoke				
- Enforcement	0.2	0	7.1	7.3
- Inspection	1.5	0	52.5	54.0
Lead				
- Reduction	61.5	0	0	61.5
- Unleaded	65.2	0	0	65.2
Natural gas vehicles	3.1	0.9	-2.0	2.0
Gasoline taxis[a]	-2.7	0	5.3	2.6
Total	128.8	0.9	62.9	192.7

[a] For a description of this policy, see text para. 53.

Source: Bank Staff Estimates (see Appendix IV.2).

Additional Cost-Effective Policies

4.43 The four basic elements of a comprehensive program for transport pollution abatement are: (a) reduce emissions per kilometer driven; (b) alter fuel choices; (c) promote modal shifts; and (d) limit overall demand for transport. The previous section has examined government's current program for addressing (a) and (b). This section draws on international experience to extend government's ongoing efforts in (a) and (b). Policies for (c) and (d) are also discussed. Where data permit, an analysis of cost-effectiveness of policies is presented.

4.44 The analysis presented in Part B of this chapter points to the most important transport-related emissions and identifies the main culprits in the transport fleet. The priority pollutants are lead, total suspended particulates, nitrogen oxides and hydrocarbons, which contribute to ozone and smog. The priority culprits are motorcycles, especially two-stroke engines, and vehicles in urban centers.

Reducing Emissions Per Kilometer Driven

4.45 Emission Standards. Malaysian authorities have so far regulated only black smoke emissions. If they were to move to advanced standards, hydrocarbon and carbon monoxide emissions could be reduced by more than 95 percent, and emissions of nitrogen oxides by about 80 percent, compared to uncontrolled levels (see also Table 4.1). Such impressive reductions are the reason new emission standards have been adopted in many countries, developed as well as developing. The experience, however, is that manufacturers will not introduce these controls voluntarily because they add to production costs, increase vehicle maintenance cost, and result in additional fuel costs. Thus, either emission standards have to be made mandatory or economic incentives need to be given to switch to low-emission engine technologies.

4.46 Basically, three sets of international emission standards and accompanying test procedures exist: the U.S. standards, and the somewhat less stringent EC and Japanese standards. The 1981 U.S. standard is the defacto world standard for light-duty gasoline vehicles, and some Asian countries such as Hong Kong, Taiwan, and Korea have adopted it (see Table in Appendix IV.3). Two of Malaysia's neighbors, Singapore and Thailand, have decided to implement the UNECE standards, and Malaysia also seems to be headed in that direction. Appendix IV.4 gives an overview of the 1992 DOE proposal for emission standards.

Cost Simulation

4.47 The effects of imposing emission standards on new light-duty vehicles and on motorcycles on the pollutant loads as well as on costs in the year 2000 have been simulated in Table 4.9 (see Appendix IV.5 for details). The year 2000 has been chosen because the turn-over of the fleet to vehicles embodying the new emission control technologies would be more or less completed by then, if the standards were imposed fairly soon. Unfortunately, the data does not permit comparison of the absolute values for the emission reductions in Table 4.9, referring to emissions in 2000 that would occur with and without standards and controls, with the results in Table 4.7. But at least the results give some indication of the relative cost-effectiveness of various standards.

4.48 The effects of emission standards for light-duty vehicles have been simulated only for private cars, although taxis, vans, and small trucks also would be affected. Private cars account for the bulk of emission reductions as since they form such a large part of the vehicle fleet. It is assumed that a standard similar to U.S. 1981, which requires catalytic converters[19] would be imposed. The cost of the necessary control equipment was assumed to be RM 1600 (the estimate given by Faiz et al (1992)), or about 50 percent of the current cost in Malaysia. From 1990 to 2000, emissions from private cars would increase 53 percent without policy interventions (BAU) due to the growth in the car fleet.

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[19] Standards that do not require catalytic controls are not considered here, because the emission factors associated with them are only slightly better than those established by JICA for 1990/91 car models.

The imposition of standards would be counteracting and would even reduce emissions in the year 2000 by 60 percent compared to the 1990 level and 74 percent compared to the 2000 BAU level. The cost of the standard for car owners would be about RM 515 million annually (or RM 272 per car), most of which would be for control equipment. This results in a cost of about RM 1700 per ton of emissions reduced (CO+HC+NOx). Accounting for reduced emissions of other pollutants, especially lead, the cost estimate would come down considerably.[20]

4.49 Motorcycles. The imposition of emissions standards for new motorcycles would reduce emissions substantially,[21] at relatively low cost. The two standards being considered involve control measures that decrease hydrocarbon and carbon monoxide emissions at the expense of nitrogen oxide emissions. This is the reason for the relatively smaller emission reductions when they are weighted according to toxicity. The less stringent standard not requiring catalytic converters is slightly more cost-effective than the tougher standard, which is similar to the current Taiwanese standard.

4.50 Taking into account the large amount of emissions which motorcycles, especially of the two-stroke kind, are currently producing (64 percent of hydrocarbon, 37 percent of carbon monoxide and 23 percent of particulate matter in Klang Valley) and the excellent cost-effectiveness of standards, DOE needs to reconsider its policy of benign neglect toward this polluting mode of transport. In designing a new standard, the DOE would do well not to follow Thailand's current lenient standard (ECE R40), which can be met even by two-stroke engines. A much better guide would be the more stringent Taiwanese standard. This will help bring down emissions from this source substantially.

4.51 An argument is sometimes made that tough standards imposed on motorcycles would hit the poor disproportionately since they are the main users of this mode of transport. This argument has to be weighed against the cost of pollution in terms of damage to health which also affects the poor disproportionately.

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[20] For example, for a standard equivalent to U.S. 1981 for passenger cars, the World Bank Mexico City study derives a cost-effectiveness estimate of US$669 (about MR 1670) per toxicity-weighted ton of emissions reduced (including SOx, PM10, and lead).

[21] The calculations were done on the basis of a 50 percent share of two-stroke motorcycles. If their share is higher, the reduction in emissions would be higher, but not the cost.

Table 4.9: Emission Standards for Private Cars and Motorcycles, 2000

	Private car	*Motorcycle*	
	Cat[a] (US'81)	*Non-Cat[b]*	*Cat[a]*
Emission reduction ('000 T CO+HC+NOx)			
Unweighted	301	332	647
in percent of BAU[c]	74	62	297
Weighted	390	425	513
Annual cost, p.a. (mill RM)			
Fuel	-214	0	88
Maintenance	237	0	0
Equipment	493	117	167
Total	515	117	254
Cost per ton of CO+HC+NOx reduced (RM/T)			
Unweighted	1715	351	393
Weighted	1321	274	496

[a] Cat = Standard requiring the use of catalytic converters.
[b] Non-Cat = Standard requiring non-catalytic control measures.
[c] BAU (business as usual) refers to emissions in a scenario without emission controls.

Source: See Appendix IV.5.

4.52 Inspection and Maintenance Programs.[22] Emissions standards can be enforced only if there is an effective inspection and maintenance program. Inspection and maintenance programs discourage tampering with emission controls or misfueling, but they also ensure that emission control benefits are not lost through poor maintenance. Furthermore, inspection and maintenance for older, pre-emission standard vehicles helps to identify maladjustments or other mechanical problems that cause high emissions. According to U.S. data, inspection and maintenance programs can reduce hydrocarbon and carbon monoxide emissions by about 25 percent and nitrogen oxide emissions by 10 percent.

4.53 The central issue in cost-effectiveness of an inspection and maintenance program is whether the procedure is centralized under government control or is decentralized and privately run. The experience is that centralized, government-controlled programs are more effective than decentralized programs. U.S. experience has shown that in centralized facilities, inspection costs (due to economies of scale), as well as the frequency of improper

[22] See Faiz et al, 1992 for a detailed discussion.

inspections, tend to be lower, and the average failure rate is almost twice as high. But this greater effectiveness may be offset by greater inconvenience for the vehicle owner. Still, an analysis for Mexico City shows that a centralized system is more cost-effective in reducing emissions than a garage-based system, even taking into account time costs. I/M programs for high-use vehicles are much cheaper than programs for passenger cars due to the much larger number of passenger cars.

4.54 Licensing of Private and Commercial Vehicles. The government can use the licensing process to address environmental concerns by influencing the number of licenses, setting conditions on the licenses issued (e.g., prescribed engine technology and maintenance schedule), and regulating the level and structure of license fees. In Malaysia all vehicles have to be licensed. Operating licenses for commercial vehicles (taxis, buses, trucks) are issued for a term of five years by the Commercial Vehicle Licensing Board (CVLB) in the Ministry of Public Enterprises (MPE). Licenses are allocated on the basis of a quota system, preferably to Bumiputra (a legacy of the NEP). Every six months, commercial vehicles have to be inspected for safety and for black smoke emissions. Since 1990, licenses for taxis in Kuala Lumpur are given out only for new gasoline or NGV powered vehicles. The restriction to engine capacity of at least 1468 ccm will ultimately create a taxi fleet consisting only of Proton Sagas, which are the least expensive cars. In fact, the proportion of diesel taxis is much lower in Kuala Lumpur (35 percent) than in the national average (64 percent). Taxi licenses are issued only to companies on the assumption that companies would be easier to regulate and would maintain their fleet better than individual taxi owners.

4.55 Road freight transport is the most heavily regulated transport subsector (see World Bank 1988). This resulted in an increasing number of owner-operated trucks for which restrictions are less stringent and of small trucks under 2,500 kg, which are not regulated. Since owner-operated trucks are usually loaded in only one direction, and smaller trucks are more costly to operate, regulation indirectly results in increasing transport costs as well as higher emissions per ton-kilometer.

4.56 Annual vehicle license taxes ("road taxes") vary by vehicle type, fuel type, size, and type of ownership or function. Road tax rates for diesel vehicles are four times those for gasoline vehicles to compensate for the much lower price of diesel (see below). For example, the vehicle license tax for a standard passenger car (1468cc) is RM 283 for a gasoline engine and RM 1132 for a diesel engine (1992). Taxes for the same size taxi are RM 88 and RM 323, respectively.

Altering Fuel Choices

4.57 Clean fuels are sometimes considered an alternative to emission standards for emissions abatement, but the potential reduction in emissions through fuel reformulation is only of the order of 10 to 30 percent (Faiz et al, 1992). The advantage, however, is that they can take effect quickly and can easily be targeted geographically and seasonally. The direct interventions for altering fuel choices in Malaysia are switching to unleaded gasoline, reducing the sulphur content of diesel, and encouraging the use of natural gas vehicles.

The indirect interventions are in the form of altering the structure and level of fuel prices.

4.58 Unleaded Gasoline. The Malaysian government has already taken several measures to reduce lead emissions of gasoline: reduction in the lead content to 0.15g/l and the introduction and subsidization of unleaded gasoline. Unfortunately, with the growth in vehicle fleet, the reduction in lead emissions will be wiped out in a few years if no additional measures are implemented (see para 28b).

4.59 A total ban on leaded gasoline (as in Austria and Switzerland in the 1980s) would have the beneficial effect of eliminating the health costs associated with lead (discussed in Chapter II). Assuming a cost increase of RM 0.06 per liter, the total cost of a ban of leaded gasoline would have been RM 230 million (which is about 5% of the expenditure on gasoline in 1992) in 1992. This is only a fraction of the estimated benefits of RM 43.7 billion (see para 26. chapter 2). If gasoline consumption increases by about 5 percent a year, the cost would increase to about RM 290 million in 1995 (5.3% of the 1992 gasoline expenditure). (There would also be some additional cost of making older vehicles compatible with the new fuel.)

4.60 A reduction in lead levels of close to 90 percent (about 83 percent) could also be achieved by reducing the lead content of gasoline further to 0.026 g/l, which is the present standard in the United States. This would add RM 0.03-RM 0.04 to the current cost of leaded gasoline, but unlike unleaded gasoline, this low-leaded gasoline would be compatible with all vehicles.

4.61 Policy interventions change the relative prices of leaded and unleaded fuel would also contribute to a change in demand for leaded and unleaded gasoline. The implications of this are discussed below in the context of overall reform of petroleum product pricing to reduce demand. Furthermore, mandatory emissions standards requiring catalytic converters would also increase demand for cleaner, unleaded fuel since leaded gasoline would destroy the converter.

4.62 Diesel. The environmental problems of diesel fuel stem from its high sulphur content (currently 0.4 percent in Malaysia compared to 0.003 percent in gasoline) and its particulate emissions, which are at least 10 times higher than those from gasoline (see Table 4.1). Particulate emission control equipment for diesel engines is typically very expensive and requires more frequent maintenance than advanced emission controls for gasoline vehicles. Many countries have therefore opted for fuel switching instead (see, e.g., Barron, 1992 on Hong Kong).

4.63 The Malaysian government, using command and control measures, is moving toward both more frequent testing of the diesel engine fleet and switching to cleaner fuels. The DOE draft of the Diesel Emissions Control Act specifies the following special provisions for certain classes of diesel vehicles: fleet operators (owning and operating 10 or more diesel vehicles) have to have their vehicles tested at least monthly. Public service vehicles operating in Kuala Lumpur, Petaling Jaya, Georgetown, Johor Bharu and seven other cities have to undergo a smoke test every two months. New public service vehicles in the four cities listed above have to be equipped with engines running on liquid petroleum

gas or compressed natural gas (bi-fueling system with gasoline permitted). By the first of January 1997 every public service vehicle in these cities has to be powered by gasoline or alternative fuels.

4.64 The DOE proposal would put into law some of the licensing conditions practiced in Kuala Lumpur by the Commercial Vehicle Licensing Board. In Kuala Lumpur, newly licensed taxis have to be fueled by gasoline or alternative fuels. This idea is extended to public service vehicles (not taxis!) in the major urban centers in Peninsular Malaysia, that is, diesel buses will have to be converted. Thus, in Kuala Lumpur diesel vehicles will effectively disappear except for diesel trucks.

4.65 A market-based alternative to the described command-and-control approach would be to abolish the implicit subsidy of diesel fuel and raise its price to the gasoline price level. This would eliminate the current cost advantage of diesel fuel for high-use vehicles. This price increase could be confined to the transport sector, if diesel fuel used in other sectors could be easily identified. In Germany, for example, this is done by coloring the subsidized diesel fuel used in the agricultural sector.

4.66 Natural Gas Vehicles. Using natural gas as a transport fuel reduces carbon monoxide emissions by about 84 percent and hydrocarbon exhaust emissions by 80 percent, while virtually eliminating evaporative hydrocarbon emissions (compared to the uncontrolled level for gasoline cars). Its drawbacks are relatively high nitrogen oxide emissions (about equal to the uncontrolled level). Conversion to a bi-fueled vehicle costs about RM 2300 (about US$1000; Faiz et al (1992) report conversion cost of US$2500-US$4000), whereas the cost of a dedicated NGV vehicle is estimated to range between US$700 and US$1500. Due to higher fuel efficiency, the higher capital cost can be recovered relatively soon.

4.67 Some lessons can be drawn from New Zealand's experience with a natural gas conversion program, launched in 1979. By the end of 1986, 110000 vehicles (11 percent of all cars and light trucks) had been converted. The government offered vehicle conversion grants, subsidies to fueling stations, and tax benefits to consumers. The average payback period was about two years. The experience in New Zealand shows that a large market for an alternative fuel can be developed in a relatively short time, but that substantial subsidies have to be offered to induce private car owners to convert their vehicles.

4.68 The Malaysian government currently offers several incentives to consumers (subsidies for conversion kits and price subsidies for natural gas vehicles; see para 39) in order to induce conversion to natural gas vehicles. Currently mainly taxis have taken advantage of this program. Taxis ply at least 50,000 km annually, so for these vehicles, the payback period of only ten months for the conversion costs is extremely short. For a private car owner, driving on average 20,000 km, the payback period of twenty-four months is also quite short.

4.69 For the NGV program to make a serious dent in carbon monoxide, hydrocarbon and nitrogen oxide emissions, the number of vehicles converted would need to be much larger. Currently the expectation, expressed in the INEP study, is that by the year 2000 about 1 percent of total kilometers driven will be in

natural gas vehicles, involving about 19,000 private cars and 1500-2000 taxis, buses, and trucks. Simulations show that nationwide the natural gas vehicles program would not result in discernable emission reductions, resulting in very high cost per ton of emissions reduced. Beneficial effects, especially reductions in sulphur monoxide and particulate emissions, would really begin to show if all taxis and buses in the Klang Valley would convert to natural gas.

Promoting Shift in Modes

4.70 An efficient public transport system and accompanying traffic restraint measures in urban centers seem to be the only policy measures that can avoid the social costs of the transport sector as can be observed in such cities as Bangkok, Mexico City, and Djakarta. Singapore and to some extent Hong Kong are examples of a successful combination of these policies.

4.71 If public transport is to serve as an instrument to reduce air pollution, motorists have to be induced to switch from the more polluting (per passenger-kilometer) private vehicles to the less polluting public transport mode. They will do this only if the costs of public transport are lowered, say, by improving service, or the costs of owning and operating private vehicles are raised.

4.72 Current Structure of Public Transport. The existence of a reliable public transport system is essential for the success of policies for controlling the volume of traffic in congested urban areas. The use of public transport for passenger transport presently (1990) amounts to around 35 percent (INEP), including travel by rail, air, and boat. Rail-based transport has lost much of its importance, and, at present, no rail-based commuter or intracity rail system exists in Malaysia. If non-road transport is neglected, only bus transport remains as a public transport mode in Malaysia. Its share (in passenger kilometers), which had declined to 26 percent in the recession year 1985, recovered to 31 percent of total road passenger-kilometers in 1990.[23]

4.73 Public road transport is in the hands of private companies: the government, through the Commercial Vehicle Licensing Board (CVLB), issues licenses for bus lines as well as taxis, regulates the fares, and provides regulatory control. Fares had last been increased in 1984 for buses and in 1987 for taxis. In 1991, the Ministry of Public Enterprises commissioned a study on the profitability of the public transport system in order to review a fare increase. Although the results showed that operations were sufficiently profitable, fares were increased countrywide in October 1992. The fare structure for stage buses is distance-based with 30 sen for the first and 5 sen for each additional kilometer; for minibuses it is flat with 60 sen per trip.

4.74 Public transport in Klang Valley includes several classes of buses: stage buses (Klang Valley 8 companies, 326 routes with 1360 buses, 255 million passengers annually, 50 percent of all trips); minibuses (38 routes with 485

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[23] If taxis are included as public transport mode, the nationwide share goes up only insignificantly.

buses, 92 million passengers annually, 27 percent of all trips); and other buses (23 percent of all trips; 1989 information based on SEATAC 1990, p.2-79). Occupancy rates as well as travel speed vary considerably between peak and off-peak hours (information from JICA KVTS 1986): for stage buses average occupancy is 58 and 23 passengers, for minibuses 38 and 19 passengers, for peak and off-peak hours, respectively. Average bus travel speeds for stage and minibuses are 18 and 34.5 km/h, respectively, and considerably less on congested roads. Bus priority lanes do not effectively exist.

4.75 The accumulated licenses given out by the CVLB for taxis (including hire cars) are 33,000 in Malaysia. Twenty-seven percent (8766) of these licenses are for Kuala Lumpur. As of October 1992, taxi fares are RM 1.50 for the first two kilometers and RM 0.10 for each additional 200 meters.

4.76 New Plans. The Malaysian government has embarked on a public transport improvement strategy for the Klang Valley (see the map of Klang Valley in Figure 4.4). An integrated transit system is planned, consisting of a rail-based commuter system, a metropolitan commuter system (light rail transit, LRT), a downtown monorail system, and improved bus service. The contracts for the first phase of the LRT system were signed with a private consortium in December 1992. The 12km project will cost about RM 1300 million and is scheduled for opening in 1996.[24] The LRT system will be complemented by a system of feeder buses, park&ride schemes, and the like. Since the current bus system in the Klang Valley is perceived as fragmented and inefficient, a reorganization ("amalgamation") is likely, which would merge the eight existing stage bus companies into one or two companies. Judging by current plans, the government seems to favor private monopolies to provide public transport services. Since the government has not yet provided information on the proposed LRT project, its effect on air quality and congestion cannot be evaluated in this report.

4.77 If the LRT is complemented, upon completion, by traffic restraint measures, such as parking controls and restrictions (see below) and limited access to the city center in Kuala Lumpur (area licensing scheme or cordon pricing), and higher fuel prices (see below), many motorists would switch to public transport. The 1987 JICA "Klang Valley Transportation Study" estimates that cordon pricing with a fee of RM 2.0 would reduce vehicle trips in the Central Planning Area (CPA) of KL by about 20 percent. JICA estimated that with an extensive rail-based public transport system (consisting of metropolitan rail transit and LRT; see Figure 4.2), the share of the public mode would increase to 36 percent. This is a far lower share than the 60 percent share which authorities in Kuala Lumpur hope to achieve with the integrated transit system.

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[24] This seems to be rather expensive for the Klang Valley compared to an alternative project for an integrated bus-rail transport system which was proposed by RELK/Delcan (see the article by Tsuruoka in the Far Eastern Economic Review). It would use the existing network of railway tracks in the Klang Valley and thus come with a price tag of only around MR 2000 million, including the cost of new stations and transport equipment for the rail as well as the bus part of the project.

4.78 Parking. Municipalities are responsible for parking infrastructure, which has a strong bearing on traffic congestion. Kuala Lumpur has specified that building developers must supply a certain number of parking spaces per unit. It is estimated that in certain urban areas parking demand greatly exceeds parking supply. This is certainly the case in the Central Planning Area of Kuala Lumpur, where at the current parking rates demand is estimated to be 66,500 and supply 52,600.[25] Due to the lack of parking space, illegal on-street parking is common, (especially in the CPA) and further contributes to congestion. The rates for private off-street parking are RM 1.0 - RM 1.50 for the first hour, for on-street parking RM 0.8 for one hour. By international standards, this is relatively cheap. Low parking rates may be one reason car-pooling programs have not been successful in the past.

4.79 The combination of policies to improve public transport and restrain traffic, including the well-known area licensing scheme, has resulted in major improvements in congestion - and in air quality - in Singapore. While the inner city average peak-hour travel speed is about 10 km/h in Bangkok, Seoul, or Manila and 15 km/h in Tokyo, Singaporeans drive at an environmentally much more friendly speed of 30 km/h.[26]

Limiting Transport Demand by Increasing Fuel Prices

4.80 Fuel prices are an important component of the costs of operating a vehicle. An increase in those costs will lead to a reduction in the demand for travel, by eliminating trips or by making them shorter. It will also induce the production and use of more fuel efficient vehicles. Both of these effects will reduce fuel consumption and production of pollutants.

4.81 Taxation (or increase in taxation) of fuels, like taxation in general, has certain costs because it distorts consumer choice and can thereby reduce society's overall welfare. But fuel taxes can be an attractive alternative to income taxes because they are easier to administer and are less prone to tax avoidance and evasion. Whether they are regressive depends on tax shifting, market power, and price controls. The replacement of a corporate income tax by an equal yield energy tax may very well improve welfare. The concern that an increase in fuel taxes might exacerbate inflation may be unfounded. For example, a study for Thailand showed that an energy tax would lead to a lower increase in consumer prices than an equal yield general consumption tax.

4.82 Furthermore, an energy tax may be a cost-effective complement to abatement requirements: An efficient environmental program should target a reduction in activity levels as well as make each activity cleaner. For example, in Mexico City an increase in the gasoline tax of 6.2 U.S. cents per liter was proposed. Because this tax would reduce demand for travel (a demand elasticity of -0.4 is assumed), the targeted emission reduction of 70 percent by 1995 could

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[25] SEATAC 1990, pp. 263ff

[26] World Bank, Urban Transport Study, 1992.

be obtained at 11 percent lower social cost than without the tax (see Eskeland, 1992).

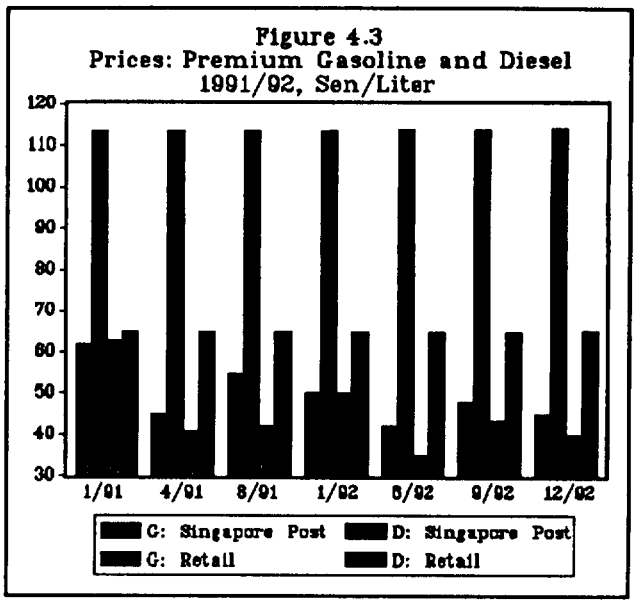

Figure 4.3
Prices: Premium Gasoline and Diesel
1991/92, Sen/Liter

4.83 Current Fuel Pricing Policy. Domestic petroleum product prices in Malaysia are closely tied to world market prices, but the government retains some control over retail prices of gasoline, diesel, kerosene, and LPG (the so-called "control items"; compressed natural gas will also be included in the list). Their prices are subject to adjustment by the "automatic pricing mechanism." Its elements are the Singapore posting price, the exchange rate, transport, distribution and marketing costs, profit margin, and dealers commission according to industry average, indirect taxes, and subsidies. For example, during the Gulf crisis in 1990/91, indirect taxes on the control items were reduced and some products subsidized with the result that sales prices increased much less than the Singapore posting prices (see Figure 4.3).

4.84 The environmental impact of energy pricing in general depends on the structure of fuel prices, that is, the relative prices of different fuels, as well as on the price level.

4.85 Structure of Prices. By taxing different fuels at different rates, the government introduces incentives for consumers that affect their choice of fuel and engine technology which, in turn, effect transport related emission. For the transport sector, the relative prices of diesel and gasoline are the most relevant. In December 1992, a liter of premium gasoline cost RM 1.13, while a liter of diesel cost only RM 0.651. This price difference creates an incentive to use diesel vehicles. To prevent private car owners from switching to diesel vehicles, annual taxes on diesel vehicles are about four times higher than those on gasoline vehicles (see para 55). This eliminates the economic advantage of diesel vehicles unless they are high-use vehicles such as taxis, buses, and trucks. Vehicle registration numbers show that in fact private diesel cars have only a 3 percent share, while the share of diesel taxis, buses, and trucks is 57 percent, 94 percent and 60 percent, respectively.

4.86 The structure of fuel process also affects consumer choice of leaded and unleaded gasoline. Currently, prices are the same, and demand for unleaded gasoline is stagnant at about 30 percent of total gasoline sales. Demand for unleaded gasoline would increase if it were cheaper than leaded gasoline. This could be achieved by having the consumer pay for the additional cost of unleaded gasoline. With the current pricing system, this would result in a price of RM 1.19 for unleaded gasoline, and increasing the price of leaded gasoline accordingly, to at least RM 1.20. Assuming that the price elasticity of demand is not zero, the price increase would also lead to some reduction in overall

gasoline demand. The issue of gasoline pricing should preferably be dealt with as part of an overall reform of the petroleum product pricing system (see below).

4.87 Level of Prices. In international comparison (Table 4.10), gasoline prices in Malaysia are much lower than those in Singapore, Japan and European OECD countries, but slightly higher than in the United States. Keeping fuel prices low is in line with the government policy to increase mobility to promote economic growth. But low fuel prices contribute to more driving in less fuel efficient vehicles, less use of public transport, and more congestion - thus, higher energy consumption and higher emissions.

Table 4.10: End-User Prices for Regular Gasoline in June 1991 (Includes Taxes) and Passenger Car Fleet Average Fuel Consumption

Country	*Price (US$/l)*	*Index (Malaysia=100)*	*Fuel Consumption (l/100 ton)*
Italy	1.11	292	7.6
Japan	0.90	237	5.9
France	0.85	224	
UK	0.77	203	
Singapore [a,c]	0.76	200	
Germany	0.69	182	10.7
Thailand [a,c]	0.42	110	
Malaysia [a]	0.38	100	11.0
Prem. Unleaded	0.41	108	
Mexico [a,b]	0.37	97	
USA	0.31	82	10.8
Indonesia [a,d]	0.21	56	

[a] Leaded, all others unleaded.
[b] As of November 1991.
[c] October 1990.
[d] January 1990.

Source: World Bank Mexico City report, 1992; Faiz et al, 1992; World Bank calculations.

4.88 Higher fuel prices promise to be an effective instrument to reduce fuel consumption and therefore vehicle emissions. The results of simulations in the Malaysian context are presented in Table 4.11 (for details see Appendix IV.6). Studies on fuel price elasticities of demand do not exist for Malaysia. Therefore, the calculations were done for two alternative values of the price elasticity, -0.2 and -0.4, which are similar to short-term elasticities for Thailand. The four scenarios combine various premium gasoline and diesel price increases:

- Scenario 1 (SIM1):
Price increases of 100 percent for both gasoline and diesel.

- Scenario 2 (SIM2):
Price increase of 100 percent for gasoline and 234 percent for diesel, which equalizes the duties on both fuels, i.e removes tax subsidy on diesel.

- Scenario 3 (SIM3):
Duties are increased of 50 percent for both gasoline and diesel, which results in price increases of 22 percent for gasoline and 9 percent for diesel.

- Scenario 4 (SIM4):
Duty increases of 50 percent for gasoline and 95 percent for diesel, which equalizes the ratio of retail to CIF price for both fuels.

While scenarios 1 and 3 only change the level of prices, scenarios 2 and 4 also adjust the structure in order to bring it more in line with the opportunity cost (= CIF prices).[27] Scenario BAU (business as usual), as discussed in Part C, assumes that fuel prices do not change.

Table 4.11: Cost-Effectiveness of Fuel Price Increases (2000)

	BAU[a]	*Price Elasticity of 20%*				*Price Elasticity of 40%*			
		SIM1	*SIM2*	*SIM3*	*SIM4*	*SIM1*	*SIM2*	*SIM3*	*SIM4*
1. Fuel consumption (tons)	7901135	6321326	5263676	7634748	7083841	4740995	3030641	7365177	6266547
2. % change		-20	-33	-3	-10	-40	-62	-7	-21
3. Emissions (tons)	964389	795539	745251	953839	927666	596654	515368	913178	860984
4. Reduction, RM		168850	219138	10551	36723	367735	449021	51212	103406
5. % reduction, RM		17.51	22.72	1.09	3.81	38.13	46.56	5.31	10.72
Price, (RM per ton)									
6. Gasoline	814	1627	1627	996	996	1627	1627	996	996
7. % Change		100.00	100.00	22.48	22.48	100.00	100.00	22.48	22.48
8. Diesel	553	1107	1849	602	1079	1107	1849	602	1079
9. % change		100.00	234.16	8.73	94.91	100.00	234.16	8.73	94.92
10. Loss of consumer surplus, RM in millions		560	1481	21	178	1119	2700	41	356
11. Cost-effectiveness, per ton		3315	6756	1959	4848	3044	6012	809	3443

[a]: BAU is identical to the scenario discussed in Part C and assumes no fuel price changes.
RM: Malaysian Ringgit;

Source: World Bank calculations (see Annex Table IV.6)

[27] SIM1 and SIM2 would raise gasoline prices to a level slightly higher than the Singapore price level in 1990 (see Table 4.10).

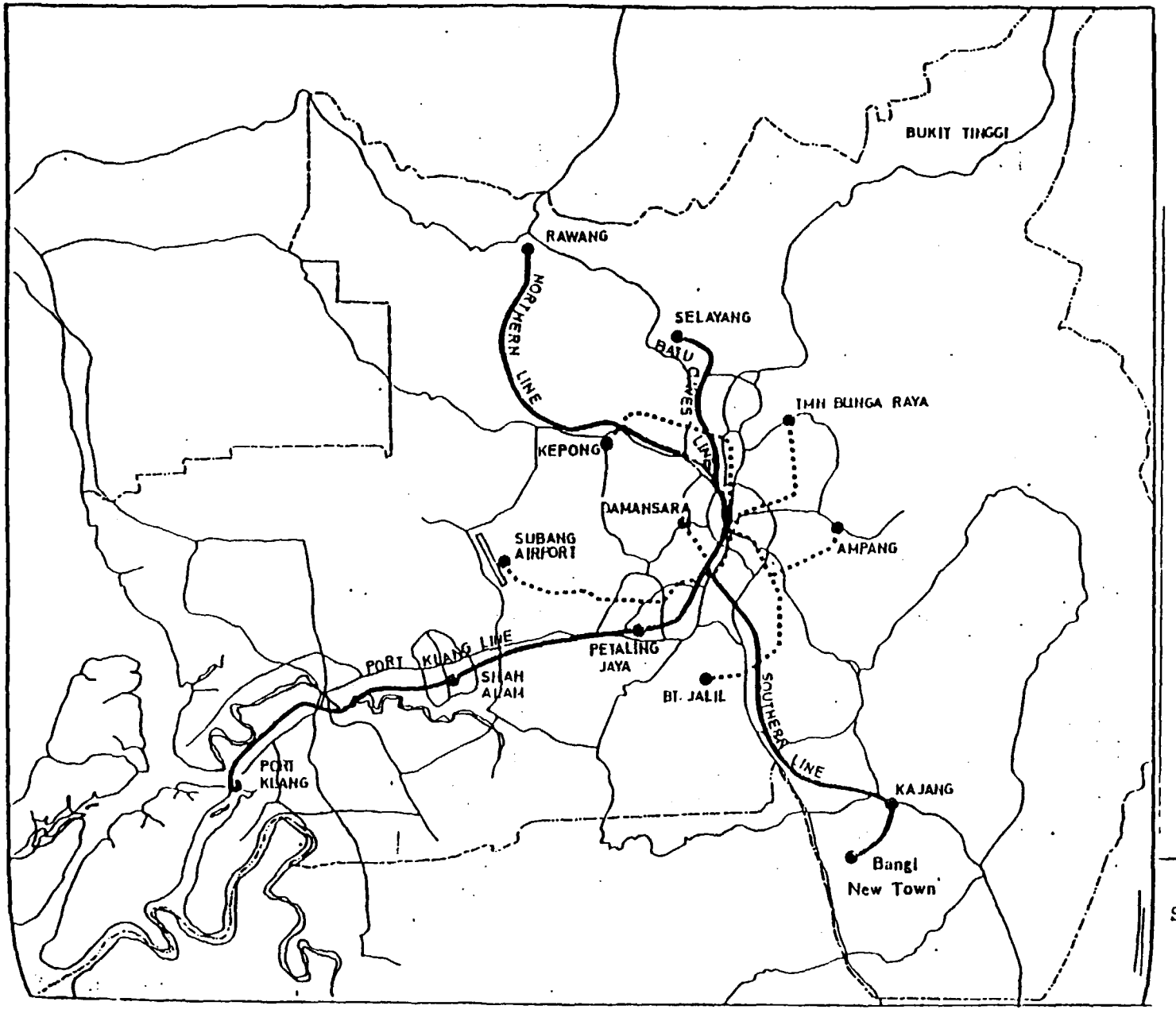

Figure 4.4
RAILWAY NETWORK
FOR 2005
ALTERNATIVE CASE
(MRT+LRT EXTENSION)

LEGEND

MRT RAILW

LRT RAILV

SCALE

0 2 4 6 8 10KM

0 2 4 6 MI

Source: JICA, 1987.

4.89 A central policy question thus is whether raising fuel prices would lower fuel consumption and reduce vehicle emissions. To answer this question an analysis is presented below establishing the relationship between fuel price change and emissions reduction in Malaysia. The analysis requires an assumption regarding price elasticities. Unfortunately, information on such elasticities is not readily available in Malaysia. The analysis presented in Table 4.11 assumes two elasticity values -0.2 and -0.4 which are similar to short term elasticities reported for Thailand. Using this assumption, four alternative scenarios are constructed using different combinations of price and duty increases for diesel and premium gasoline. The scenarios allow for both change in the level of prices as well as in the structure of prices as explained below. (Table 4.11 draws in the detailed simulations presented in Annex Table IV.6).

4.90 Table 4.11 presents the cost-effectiveness of the four fuel price and duty structure scenarios. The second row of the Table shows the decline in fuel consumption following price & duty structure changes, the fifth row shows the associated decline in emissions. However, the benefit in terms of decline in emissions is not without cost which is the loss of consumer surplus associated with reduced fuel consumption, following the price increase. The ratio of costs and benefits (row 11) then gives the ranking of the four scenarios in terms of their cost-effectiveness for reducing emissions compared to the business-as-usual (BAU) case. Row 11 shows cost-effectiveness measured as reduction in consumer loss per ton of emissions reduced. The analysis clearly shows that the policy that achieves the highest reduction in pollution (Sim 4) also has a substantial consumer welfare loss associated with it because of higher fuel prices. The most cost-effective policy is one that calls for a moderate increase in fuel prices (Sim 3) since it results in the least reduction in consumer welfare per ton of emissions reduced.

4.91 The more price-elastic the demand, the greater the degree of cost-effectiveness achieved. With an elasticity of -0.4, the 50 percent increase in duties in SIM3 results in a decrease in fuel consumption of 7 percent and in emissions of 5 percent. It leads to costs of RM 41 million, lowering the cost per ton of emissions reduced to RM 809. Scenarios SIM1 and SIM4 with their bigger decreases in emissions also reach cost-effectiveness levels that might be competitive with those of other pollution control measures.

E. Conclusions and Recommendations

4.92 Transport pollution abatement has to be a priority on the policy agenda. Pollution emissions from mobile sources are substantially larger than those of industry. The Department of the Environment estimates that in 1991 mobile sources of pollution accounted for 94 percent of carbon monoxide emissions, 44 percent of hydrocarbons, 40 percent of nitrogen oxides, and 6 percent of particulate matter and sulphur oxides. The problem has been exacerbated by a rapid expansion of the Malaysian vehicle fleet which between 1980 and 1991 grew 7 percent a year, more than doubling from 1.6 to 3.5 million vehicles. In some urban centers, vehicle growth has been even faster: in Kuala Lumpur, in the five years following the recession, vehicle growth was 10.5 percent a year.

4.93 The vehicle fleet expansion has caused two major problems. Increased total suspended particulate and lead emissions into the atmosphere are a major health hazard. And congestion imposes high time costs. This report estimates the costs of mortality and morbidity associated with these emissions to be very high; moreover it is conservatively estimated that traffic congestion in Kuala Lumpur adds fifteen minutes daily to an average car journey, or additional cost of RM 1 billion.

4.94 These costs will increase manyfold under the business-as-usual scenario. The Malaysian economy is highly-transport intensive. A large part of GDP is traded and the bulk of import intensive manufactured goods are exported. Moreover, people are commuting longer distances to work. If the target growth rate of 7 percent a year over the next thirty years is to be met, the size of the freight and passenger vehicle fleets would increase two and half times and emissions from road transport would triple, especially in urban areas. The time lost in traffic jams in Kuala Lumpur would at least double, imposing staggering costs on business.

4.95 Cost-effective policy intervention is needed to avoid business as usual. This report recommends:

- A short-term strategy of direct and indirect interventions for pollution abatement.
- A medium-term strategy for improving the data base for rational policy choice and for improving institutional coordination.
- A strategy of demand management through the provision of efficient and reliable public transport and the adoption of a more environmentally conscious energy pricing policy. (This strategy would be phased in gradually and would coincide with the short and medium term strategies).

Short-Term Measures

4.96 More Stringent Emissions Standards. This chapter has demonstrated the high pay-off from a program for more stringent emissions standards. Advanced emissions standards can reduce emissions from private cars by 74 percent by the year 2000 compared to business as usual at an average cost of RM 515 million a year spread across all vehicle owners. This is a tiny proportion of the health expenses that would be avoided by reducing human exposure to pollution. The pay-off from more stringent emissions standards is even higher for two-stroke engine motorcycles that constitute at least 50 percent of the motorcycle fleet and account for a third of all transport-related pollution. Tougher emissions standards for high-use diesel vehicles would reduce sulphur oxide and particulate emissions substantially.

4.97 Credible Inspection and Maintenance Program. Systematic inspection and maintenance of vehicles will yield better results in reducing emissions than relying exclusively on certification of manufacturers. Such programs have

reduced carbon monoxide emissions in the United States by 25 percent and nitrogen oxide emissions by 10 percent.

4.98 Promotion of Unleaded Gasoline. Perhaps the most serious health hazard of the business-as-usual scenario arises from increased lead emissions from an expanding vehicle fleet. A total ban on leaded gasoline would increase cost of gasoline by RM 0.06 per liter in 1992 and would have come with a price tag of RM 230 million (5 percent of the total expenditure on gasoline in 1992), which could have been passed on to vehicle users. (Assuming 5 percent a year growth in gasoline demand, the cost increases to RM 290 million (5.3 percent of total gasoline expenditure) in 1995.) This is just a fraction of the opportunity cost of exposure to lead. The switch to unleaded gasoline must therefore be hastened.

Medium-Term Measures

4.99 Improve Data and Information Systems. International experience suggests that a range of policy options are available for transport-related pollution abatement but that cost-benefit or cost-effectiveness criteria must be applied to tailor policies to specific situations. This requires reliable information on the operational fleet and its components and an improved inventory of emissions. Particularly important is information on costs to the population exposed to pollution and abatement costs imposed on vehicle owners and the government. Currently, such information is hard to obtain either because it does not exist or because it is not updated systematically. (If such information were available the projections and cost estimates presented in this report would have needed fewer assumptions to adapt data to Malaysia.) Improving the information base requires:

4.100 Computerized registration of motor vehicles. This program is currently being put in place and should be completed on a priority basis. It should be combined with emissions inventory updating so that pollutants can clearly and reliably be identified with their source. Information on traffic peaks and hourly traffic volumes, traffic mix and speed should also be gathered on a regular basis to identify localized problems of pollution and congestion. Information on nitrogen dioxide emissions - a special problem in Klang Valley, contributing to increasing ozone levels and acid rain - should be collected systematically.

4.101 Cost data on emissions control measures for the government and vehicle operators should be gathered and updated regularly. This should include cost information on inspection and maintenance programs. Similarly, costs of switching to cleaner fuels need to be estimated systematically.

4.102 Strengthen Institutional Coordination. Institutional coordination is needed not only to have more reliable and systematic data gathering and processing but also to execute policies efficiently and in a cost-effective manner. At present, too many agencies are involved in data gathering and policy formulation, resulting in expensive overlaps and poor coordination. Smooth coordination between the Department of Environment, the Road Transport Department, and the Ministry of Energy is particularly important. The current

project to develop integrated national energy planning (INEP) should pay close attention to the environmental consequences of energy consumption. DOE and the INEP group should develop a common data base and a common set of assumptions. Coordination with local governments, such as Kuala Lumpur City Hall, is also important since they perform an essential role in planning and implementing transport policies for their communities.

4.103 Given that several ministries and departments need to be coordinated at several levels of the government, it is recommended that EPU should be the coordinating secretariat for transport pollution abatement initiatives. To perform this function well EPU should also be the central repository for data on emissions and costs of abatement.

4.104 Coordinate Policies Within ASEAN. Malaysia's trade within the ASEAN region, but especially with Thailand and Singapore, will continue to expand. With this in mind, Malaysian policymakers should more actively coordinate environmental policies, especially for the transport sector. In fact, the DOE proposes to adopt the same emission standards that Singapore and Thailand have already adopted. Coordination should also cover testing procedures and regional laboratories for type approval and certification.

4.105 Public Education Campaigns. The costs of pollution abatement become more palatable if the public is made aware of the costs of doing nothing. Such education campaigns are crucial in winning public support for the programs. The campaign would also help create demand for the less polluting technology of the national car, Proton Saga,[22] thus making the national car policy more consistent with the government's urban environment objectives.

4.106 Urban Land Use and Traffic Flows. A strategy should also be designed to link urban land use planning with transport system design. This approach has worked well in Brazil and is particularly suited to Kuala Lumpur at this stage before transport related problems became as critical as in Bangkok. Such integrated planning could be further strengthened by capturing property value increases arising from traffic flow changes for investment in further improving the urban transport network.

A Strategy for Demand Management

4.107 Improve Public Transport and Implement Traffic Restraint Measures. In the long run, growth in the vehicle fleet will lead to an increase in transport emissions despite emission control measures. This problem will be most relevant in industrial and urban centers. The overall volume of traffic therefore has to be reduced. Improved public transport is one pillar of such a policy. The other is the introduction of traffic restraint measures, which would include

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[22] The technology exists but is currently available only in export models of Proton Saga.

discouraging private car entry into city centers through area licensing and parking restrictions, through increases in parking fees, and through rationalization of deliveries. These policies complement the modal shift toward public transport.

4.108 Rationalize Energy Pricing. The discussion presented in this report shows that fuel prices in Malaysia re lower than in neighboring countries while car ownership and its use is one of the highest. The analysis also shows that fuel price increases can have a significant impact on fuel consumption and therefore on vehicle emissions. A strategy of demand management by rationalizing fuel prices is therefore essential for a lasting impact on transport emissions. It is recommended that energy price increases and adjustments in the structure of diesel and gasoline prices be phased in along with the short and medium term measures recommended above. These increases could also be justified in terms of an energy tax to reflect environmental considerations. Such a tax would also create incentives to manufacturers to improve the fuel efficiency of vehicles.

Appendix IV.1

Scenario BAU (Business as Usual) for Transport Sector Emissions

1. How would emissions from the transport sector increase, if current transport policies were to continue (business as usual or BAU)? To answer this question, a scenario was developed that combines environmental data from DOE reports and information on the future transport sector development from the INEP study. The basic data are:

(1) Emission factors (kilograms per 1000t fuel consumption) that used by DOE, e.g., to compute the data in Table 6.3 in the EQR 1991 (quoted in Table 14 in the JICA Brief Report, November 1992, p. 64);

(2) Passenger/freight kilometer and fuel consumption data for 1990 and projections until 2020 from the INEP (Integrated National Energy Planning) study, which Dr. Zam Zam (TENAGA) completed in December 1992 for the Ministry of Energy, Telecommunications, and Posts. For the past, these INEP energy consumption data for the different modes (plus rail, air, and boat transport consumption) add up to total energy consumption of the transport sector as reported in the National Energy Balance. Furthermore, INEP provides projections for fuel consumption up to 2020.

2. Unfortunately, combining these two sets of data to derive the emissions of the transport sector results in annual emissions in 1990 which are much higher than those reported by DOE (EQR 1991, Table 6.3, p.#183). This indicates that the total fuel consumption of the transport sector according to DOE is too low, that is, lower than the total consumption as reported in the National Energy Balances.

3. As a compromise, the absolute emissions according to INEP/DOE have not been used for the purposes of this report, but rather the resulting growth rates have been applied to the 1990 DOE pollutant loads. In the period 1990 to 2020 passenger traffic is forecasted to increase 257 percent and freight traffic 287 percent, leading to a cumulative growth of 215 percent in fuel consumption (3.9 percent a year). This results in an increase of total emissions of 3.6 percent and 3.9 percent a year on an unweighted and on a toxicity-weighted base, respectively (see Table 4A.1). Emissions from the transport sector would thus roughly triple in the thirty year period. Especially in urban areas, this would result in a rise in atmospheric concentrations of these pollutants, in many cases probably surpassing the current standards and guidelines.

Table 4A.1.1: Scenario Business-As-Usual for The Transport Sector

POLLUTANT LOAD BY MODE, 1990

	Fuel '000 T	PM T/Year	SO_2 T/Year	NOx T/Year	HC T/Year	CO T/Year
GASOLINE						
Private Cars	1832.53	3665.06	989.57	18875.06	26571.69	690864
Taxis	41.70	83.40	22.52	429.51	604.65	15721
Bus	4.32	2.25	.69	24.64	42.79	350
Lorry	283.78	567.57	153.24	2922.96	4114.85	106986
Motorcycle	878.58	175.72	17.57	61.50	8785.83	14936
DIESEL	0.00	0.00	0.00	0.00	0.00	0.00
Pass. Car	69.92	167.81	531.41	769.16	181.80	3042
Taxi	43.84	105.22	333.20	482.27	113.99	1907
Bus	224.44	424.19	1705.74	11670.83	1167.08	7182
Lorry	1353.32	2557.78	10285.24	70372.67	7037.27	43306
SUM	4732	7749	14039	105609	48620	884294
Cars	1902.45	3832.87	1520.98	19644.21	26753.49	693906
Taxis	85.54	188.62	355.72	911.78	718.64	17628
Bus	228.76	426.44	1706.43	11695.47	1209.87	7532
Truck	1637.10	3125.34	10438.48	73295.64	11152.12	150292
Motorcycle	878.58	175.72	17.57	61.50	8785.83	14936

FOR COMPARISON: TOTAL POLLUTANT LOAD FROM TRANSPORT SECTOR, DOE (EQR 1991)

SUM	-	5000	3200	43200	28000	555400
% OF ABOVE	-	64.52	22.79	40.91	57.59	62.81

POLLUTANT LOAD-2020

	FUEL '000 T	PM T/YEAR	SO_2 T/YEAR	NOx T/YEAR	HC T/YEAR	CO T/YEAR
GASOLINE						
Private Cars	5282.39	10564.78	2852.49	54409	76595	1991461
Taxis	169.48	338.97	91.52	1746	2457	63895
Bus	5.17	2.69	0.83	29	51	418
Lorry	557.40	1114.80	301.00	5741	8082	210139
Motorcycle	3013.13	602.63	60.26	211	30131	51223
DIESEL						
Pass. Car	51.61	123.85	392.21	568	134	2245
Taxi	70.43	169.02	535.24	775	183	3064
Bus	799.24	1510.56	6074.20	41560	4156	25576
Lorry	4941.38	9339.20	37554.45	256952	25695	158124
SUM	14890	23766	47862	361990	147485	2506145

Source: KM and Fuel Consumption: INEP, Emission Factors: DOE.

FUEL CONSUMPTION AND POLLUTANT LOAD IN THE TRANSPORT SECTOR

	FUEL CONS '000 T	PM T/YEAR	SO_2 T/YEAR	NOx T/YEAR	HC T/YEAR	CO T/YEAR
1990	4732	7749	14039	105609	48620	884294
2000	7394	12014	22430	169617	75263	1343951
2010	10688	17299	33935	257667	107026	1867725
2020	14890	23766	47862	361990	147485	2506145

GROWTH RATES

PER ANNUM	FUEL CONS	PM	SO_2	NOx	HC	CO
1990/2020	3.89	3.81	4.17	4.19	3.77	3.53
1990/2000	4.56	4.48	4.80	4.85	4.47	4.27
2000/2010	3.75	3.71	4.23	4.27	3.58	3.35
2010/2020	3.37	3.23	3.50	3.46	3.26	2.98

CUMULATIVE

1990/2020	214.64	206.70	240.92	242.77	203.34	183.41
1990/2000	56.24	55.05	59.76	60.61	54.80	51.98
2000/2010	44.55	43.98	51.30	51.91	42.20	38.97
2010/2020	39.32	37.39	41.04	40.49	37.80	34.18

ABSOLUTE VALUES, BASED ON 1990 DOE POLLUTANT LOAD AND INEP GROWTH RATES

UNWEIGHTED

IN '000 T	LEAD	PART	SO_2	NOx	HC	CO	SUM
1990	0.56	5.01	3.23	43.29	28.01	551.36	631.46
2000	0.62	7.77	5.16	69.53	43.36	837.96	964.39
2010	0.89	11.18	7.81	105.62	61.66	1164.53	1351.69
2020	1.24	15.37	11.01	148.38	84.97	1562.59	1823.56

WEIGHTED

POLL. INDEX	85.00	3.20	1.40	4.70	1.80	0.04	96.14
1990	47.90	16.03	4.52	203.46	50.42	22.05	344.39
2000	52.39	24.86	7.22	326.78	78.05	33.52	522.81
2010	75.72	35.79	10.93	496.42	110.98	46.58	776.43
2020	105.50	49.17	15.42	697.40	152.94	62.50	1082.93

CALCULATION LEAD EMISSIONS (LEAD CONTENT 0.15G/L)

	1990	1998	2000	2010	2020
Gasoline, MIO L	3756.80	5368.53	5869.69	8484.48	11820.42
Lead Emission, T	563.52	563.70	616.32	890.87	1241.14

Assumption: 30% share of unleaded gasoline starting 1991.
Note: In 1998, lead emissions reach 1990 level again.

4. The INEP study provides very valuable information on the future development of energy supply and consumption. However, the analysis of energy consumption of the transport sector merits special comments.

5. In the analysis for the transport sector, the following assumptions are made for the basic INEP scenario (moderate growth, business as usual: MGBAU), 1991-2020 (r numbers refers to the row of the computer print-out in the INEP study):

- Mobility per capita increases as specified in r8;
- Vehicular pass-km is derived from r8 and population forecast in r6;
- Ratio of persons per car decreases as specified in r15; the implied ratio of cars per 1000 population thus increases from 64 (1990) to 125 (2020;)
- Number of operating cars is derived in r16 from r15 and the population forecast in r6; for the past this procedure seems to make sense, e.g., the ratio of operating to the total of registered cars is about 66 percent in 1990, whereas the RTD assumes 60 percent;
- Distance travelled per car (increasing) and occupancy rate (constant at 2.0) are specified in r17 and r18, respectively;
- Passenger kilometers are derived in r19 as product of r16, r17, r18;
- Same procedure for other private vehicles;
- The sum of passenger kilometers (pass-km) in all private vehicles (=r46) subtracted from total vehicular pass-km (=r9) gives public transportation pass-km (=r48); public transport share increases from 35 percent (1990) to 41 percent (2020), mainly due to increased transportation by electric train; shares of public transport modes are specified in r60-r64;
- Specific energy consumption of all modes is specified in r68-r78; it seems to be rather low; no decrease is specified after 1990;
- Energy consumption by mode (r97-r107) is the product of annual consumption per private vehicle (r67*r17, etc:) and the number of private vehicles; for public transport modes it is the product of pass-km and specific energy consumption, divided by the load factor (assumed to be constant for each mode, r88-r92).

6. Energy efficiency scenarios (EE): Specific energy consumption for each mode decreases 20 percent between 1990 and 2020, about 5 percent annually on average.

7. Targeted growth scenario (TG): Higher GDP growth leads to increase in mobility per capita and thus increase in vehicular pass-km. The number of operating private vehicles does not change; pass-km and energy consumption of private modes is therefore the same as in the MG scenario. But public transport pass-km increase, leading to an increase in the share of public transport to 54 percent!

8. Several of these assumptions do not seem very plausible:

(1) The forecast of the operating fleet implies implausible, fluctuating values of elasticities with respect to GDP. There are two compelling arguments for constancy of the elasticity of number of cars/cap

(similarly, private vehicles per cap) with respect to GDP/cap: (i) underlying consumer preferences are plausibly stable; (ii) the empirical evidence is insufficient to infer otherwise.

(2) Furthermore, the elasticities should be the same in the MG and the TG scenarios. Here, it is assumed that the elasticity of the number of cars/cap with respect to GDP/cap is 0.81, while the elasticity for other private vehicles per cap is somewhat lower (it includes mainly motorcycles and taxis), 0.76. This leads to:
(a) An increase in the number of private vehicles as compared to the original MG scenario: e.g., in 2020, 4.8 million cars versus 4.3 million and 12.6 million other private vehicles versus 11.7 million.
(b) An increase in the number of private vehicles in scenario TG as compared to scenario MG (INEP assumes the same number of private vehicles in both scenarios): e.g., in 2020, 6.1 million cars and 15.7 million other private vehicles.

(3) This has important repercussions for the share of private vehicles in transportation: the public sector share does not automatically increase with higher GDP growth as it does in the original TG scenario.

(4) The specific energy consumption of vehicles seems to be too low, especially in the case of motorcars. Even in the MGBAU scenario some degree of improvement in specific energy consumption should be specified (lower than in MGEE/TGEE).

Appendix IV.2

Costs of Current Environmental Policies for the Transport Sector

Black Smoke Emissions

A) BS Enforcement Campaigns	1990	1991	Remarks and Sources
Number of Campaigns	439	465	DOE
Total # Vehicles Stopped	38322	40487	DOE
Vehicles Stopped/Campaign	87.294	87.069	-
Hours per Campaign	8	8	???
Persons per Campaign	5	5	???
Wage/H, RM	6.75	6.75	WDR 1992
Total Labor Cost	118530	125550	-
Other Cost	59265	62775	50% of Labor Cost ???
Total Cost, RM	177795	188325	-
Summons Issued	7199	9444	DOE
Cost per Summon	24.70	19.94	-
% Compliance	81.21	76.67	-
Fine	500	500	Motor Vehicle Rules 1977
Total Fines	35995500	4722000	-
Repair Costs per Summon	250	250	Minimum Repair cost in US
Total Repair Cost	1799750	2361000	-
Total Cost, MILL RM	5.577	7.271	-

B) BS Inspection Commercial Vehicles		Remarks and Sources
OP. COMM VEH, '000	300	RTD
% Fail	0.35	DOE
Failed, Veh, PA, '000	210	-
Repair Cost	250	Minimum Repair Cost in US
Total Repair Cost, MILL	52.5	-
Material	40000	???
Labor	1485000	???
Total Inspec. Cost, MILL	1.525	
Total Cost, MILL	54.025	

Lead Policy

C) Government Subsidy Unleaded Gas, 1992		Remarks and Sources
Sales Peninsula, 000 L	1094.00	Treasury
Average Subsidy, SEN/L	0.0528	Treasury
Subsidy Peninsula, MILL M	57.78	Treasury
Subsidy Sabah+Sarawak	7.42	Treasury
Total Subsidy, MILL RM	65.20	Treasury

D) Reduction in Lead Content, starting 1.1.1990

	1990	1991	1992
Cost, SEN/L	0.02	0.02	0.02 ???
Total Gasoline Sales, ML	3757	3957	4169 NEB
Leaded Gas. Sales, MILL L	2901	3135	3075 PETRONAS
Unleaded	0	0	1094
% Unleaded	0.00	0.00	0.26
Total Cost, MILL RM	58.02	62.70	61.49

E) NGV Policy	1992	Remarks and Sources
Vehicles Converted	960	PETRONAS
Cost per Veh., RM	2300	PETRONAS
Annualized (5yrs, 6%)	546	-
Conversion Cost/year	524171	-
Difference Fuel Cost	-2506272	-
KM/Year	50000	INEP
Spec. Gasol. Cons, L/KM	0.1	PROTON
Gasoline Price	1.13	MDT
Gasoline Cost Per Veh.	5650	-
Total Gasoline Cost	5424000	-
Spec. NGV Cons.	0.099	1% Less than Gasoline ??
NGV Price	0.614	PETRONAS
NEV Cost per Vehicle	3039.3	-
Total NGV Cost	2917728	-
Total Cost Public/Year	-1982100	-
Capital Cost, Petronas	6000002	PETRONAS
Annualized (10 Years,6%)	815208	-
Operating Cost, PETRONAS	100000	Labor, Training, PR ???
TOTAL COST	915207.9	-
PETRONAS/YEAR	662400	Treasury: 5% duty instead of 35%
GOV. DUTY LOSS ON KITS		
Gov. Fuel Subsidy	2438400	Treasury: Duty Exemption of 0.508
TOTAL COST, MILL RM	2.033907	SEN/L
		-

Assumptions: Only taxis are converted, which otherwise would use gasoline
Road tax on NGV is the same as on gasoline vehicles.

F) Licenses for Gasoline Taxis only in Kuala Lumpur

	1992	Remarks and Sources
Taxis affected	1500	RTD ???
Cost Difference per veh., RM	5000	???
Annualized (5 Years, 6%)	1187	-
Conversion Cost/Year	1780473	-
Road Tax Gasoline	88	RTD
Tax Difference	-235	-
Total Tax Difference	-352500	-
Difference Fuel Cost	3909862	-
KM/Year	50000	INEP
Spec. Gasol. Cons, L/KM	0.1	PROTON
Gasoline Price	1.13	MDT
Gasoline Cost Per Veh.	5650	-
TOTAL GASOLINE COST	8475000	-
Spec. Diesel Cons.	0.0935	6.5% Less than Gasoline ??
Diesel Price	0.651	PETRONAS
Diesel Cost Per Vehicle	3043	-
TOTAL DIESEL COST	4565138	-
TOTAL COST PUBLIC/YEAR	5337836	-
Gov. Road Tax Loss	352500	-
Gov. Fuel Revenues	30376677	-
Total Gov. Cost/year	-2685176	-
TOTAL COST, MILL RM	2.65	-

Assumptions: Without taxi licensing requirement, diesel share in Kuala Lumpur would be equal to National Diesel Share.

Appendix IV.3

Emission Standards and Control Measures

Emission Standards for New Gasoline Vehicles (G/KM)

U.S.	CO	VOCs	NOx	
Before controls	54	5.4	2.5	
1968	32	3.7	3.1	
1981	2.1	0.25	0.63	De Facto World Standard
1990				
Mexico, 1990 Model	28.8	2.88	3.2	
1993 Model	3.4	0.4	1	
Korea, as of 7/87	2.11	0.25	0.62	Also Evap. HC
Malays., 90/1 &	7.7	2.5	2.5	

Emission Standards for Motorcycles

Taiwan Standard, 88	8.8	6.2	0.3	HC+NOC=6.5
1991	4.5	2.7	0.3	HC+NOX=3.0
Swiss/Austr, 4-STROKE	13	3	0.3	
Malaysia/JICA/EPA&	17	9.9	0.075	

&: No Standards; JICA Emission Factors of 90/91 Models

Emission Factors for Emission Control Measures

	CO	HC	NOx	Change in Fuel Economy	Cost RM
A) For Light-Duty Gasoline Vehicles					
Uncontrolled	24.45	2.49	2.109	0	
Non-cat controls	15	1.5	1.9	-5	325
Oxyd. cat	7	0.5	1.3	-5	950
US 1981 standard	2.1	0.25	0.63	-5/+5	1575
Lean-burn engine	1	0.25	0.63	15	1575
B) For NEV					
Controlled	0.3	0.05	0.5	0.01	2300
Uncontrolled	4	0.5	2.1		
C) For motorcycles					
2-stroke	18	8.3	0.125	0	
4-stroke/adv.2str	12	5	0.5	25	150
Non-cat controls	12	1.4	0.3	0	175
Oxyd. cat	5	0.3	0.3	-5	250

Source: Faiz et al, 1992

Appendix IV.4

The 1992 DOE Proposal for Emission Standards

1. DOE proposes to impose UNECE Regulation 15-04 on new gasoline engines. Manufacturers, assemblers, importers and retailers (short: manufacturers) are required to obtain a license of conformity from DOE. When applying for the license, the manufacturer has to pay a processing fee of RM 300 and submit, among others, a type approval certificate, information on the conduct of type approval test, on projected manufacture or sales figures, on maintenance schedule and equipment, and on the location of workshops able to maintain the engine. In the absence of local type approval testing facilities, the manufacturer has to demonstrate that a type approval test has been conducted and the results are in compliance with the UNECE regulation. Engines complying with equivalent or more stringent emission standards or test procedures (e.g. the Japanese 10-mode exhaust emission test) will also be granted the license of conformity. The license is finally granted upon the payment of a licensing fee (RM 1000 for the first unit and RM 20 for each subsequent vehicle of the same engine type). DOE can verify the emission compliance by having tested, at the manufacturer's cost, no more than 1% of annual projected number of vehicles manufactured. If the manufacturer is not in compliance, he has to pay a "fine" (DOE "recovers the fee"), depending on numbers manufactured and the percentage in violation, up to a maximum of RM 10000. The fine is waived if it is less than 10% of the licensing fee.

2. Owners and drivers of new vehicles not complying with the standards commit an offence. Prior to delivery, the vehicle has to be inspected, tested and adjusted and then certified. At the end of the warranty period, or after 10000 and 50000 km, the licensee has to inspect, test and adjust the engine again. The regulations contain a provision for recall, adjustment and repair.

3. In-use gasoline vehicles have to comply with emission standards for HC and CO. They are 4.5 percent CO and 880 ppm HC for existing models and 3.5 percent CO and 600 ppm HC for new models. The former are identical to the Singapore standards, which are considered to be quite lenient (Faiz et al). Vehicles may be stopped for inspection and emission testing. If they fail the test, a prohibition order can be issued which requires that the vehicle be serviced and adjusted at an approved maintenance facility before being operated again. Emission tests are to be carried out in one of 11 facilities to be set up in Malaysia.

4. Licensees have to maintain calibration and testing facilities in every state or enter into an agreement with a third party if projected annual sales are below 120. Persons committing offenses are punishable under the EQA 1974 (maximum fine of RM 10000).

5. The amount of licensing fee and fine for failing to comply were calculated for annual sales of 100000 vehicles (which is incidentally the annual PROTON output): The manufacturer would have to pay licensing fees of RM 2.001 million a year and a fine of RM 10000 if 1 percent of the samples violate the standard (if no maximum fine were imposed, RM 25000 would have to be paid). The upper limit of the fine thus benefits all manufactures producing more than 40000

vehicles annually (under the assumed percent of non-compliance). But, the same regulation also specifies that no fine shall be paid if the amount would be less than 10 percent of the licensing fee. This effectively precludes the payment of fines in all but very few cases: Big manufacturers never pay, and small ones only if the percentage of violation is very high, say 10 percent. Thus, the fine will not act as a deterrent for manufacturers not to comply with the standard.

6. The emission control provisions for diesel vehicles are similar to the provisions for gasoline vehicles. The main differences are: New diesel engines will have to meet the UNECE standard (DOE did not provide the specifics). The proposal also extends the control of black smoke emissions from motor vehicles (1977) to every mobile or stationary diesel engine. It specifies that exhaust emissions not be visible for a period of more than 10 seconds and that smoke emitted not be denser than 50 HSU when tested under free acceleration. As specified in the 1977 regulation, road tests can be carried out. New is the specification of prohibition orders (see above), if a vehicle is emitting smoke denser than 70 HSU (for the second time within three months), and in special cases 60 HSU.

7. The diesel emission control act specifies the following special provisions for certain classes of diesel vehicles: Fleet operators (owning and operating 10 or more diesel vehicles) have their vehicles to be tested at least monthly, either in their own smoke testing facilities or in another acceptable testing facility. Public service vehicles operating in KL, PJ, Georgetown, Johor Baru and seven other cities have to undergo a smoke test every two months at an acceptable smoke testing facility. New public service vehicles in the four cities listed above have to be equipped with engines running on LPG or CNG (bi-fueling system with gasoline permitted). By January 1, 1997 every public service vehicle in these cities has to be powered by gasoline or alternative fuels. Contravention licenses may be granted.

Appendix IV.5

Simulations: Effects of Emission Standards

A) EMISSION STANDARDS FOR LIGHT-DUTY VEHICLES (BASED ON INEP)					TOXICITY WEIGHTS				
				0.04		1.8		4.7	
1990		E FACTORS, G/KM				EMISSIONS, '000 T			
	KM, 10^9	CO	HC	NOx	CO	HC	NOx	SUM	WEI SUM
Priv. cars	23.51	-	-	-	-	-	-	-	-
Gasoline	22.51	7.74	1.5	2.5	174.23	33.77	56.28	264.28	332.25
Diesel	1.00	1.1	0.29	0.99	1.10	0.29	0.99	2.38	5.21
Total	26.40	-	-	-	195.28	39.48	84.63	319.38	476.62
NO STANDARDS									
2000		E. FACTORS, G/KM				EMISSIONS, '000 T			
	KM,10^9	CO	HC	NOx	CO	HC	NOx	SUM	WEI SUM
Priv. cars	35.94	-	-	-	-	-	-	-	-
Gasoline	34.41	7.74	1.5	2.5	266.35	51.62	86.03	404.00	507.92
Diesel	1.53	1.1	0.29	0.99	1.68	0.44	1.51	3.64	7.97
Total	40.77	-	-	-	301.90	61.44	135.74	499.08	760.65
US 1981 STANDARD									
2000		E. FACTORS, G/KM				EMISSIONS, '000 T			
	KM, 10^9	CO	HC	NOx	CO	HC	NOx	SUM	WEI SUM
Priv. cars	35.94	-	-	-	-	-	-	-	-
Gasoline	34.41	2.1	0.25	0.63	72.27	8.60	21.68	102.55	120.27
Diesel	1.53	2.1	0.25	0.63	3.21	0.38	0.96	4.55	5.34
Total	40.77	-	-	-	105.87	17.34	69.02	192.24	59.87

CHANGE IN EMISSIONS 1990/2000 WITHOUT EMISSION STANDARD ('000T)
(NEGATIVE SIGN MEANS INCREASE)

	CO	HC	NOx	SUM	WEI SUM
Total	-106.62	-21.96	-51.12	-179.70	-284.04
%	-54.60	-55.62	-60.40	-56.26	-59.59
Cars	-92.70	-18.01	-30.28	-140.98	-178.42
%	-52.87	-52.87	-52.87	-52.87	-52.87

CHANGE IN EMISSIONS 1990/2000 WITH EMISSION STANDARD ('000T)

	CO	HC	NOx	SUM	WEI SUM
Total	89.41	22.14	15.60	127.14	116.75
%	45.78	56.07	18.43	39.81	24.49
Cars	99.86	25.07	34.62	159.55	211.86
%	56.95	73.62	60.46	59.84	62.78

EMISSION REDUCTION IN 2000, EMISSION STANDARD ('000T)

	CO	HC	NOx	SUM	WEI SUM
Total	196.03	44.10	66.72	306.84	400.78
%	64.93	71.77	49.15	61.48	52.69
Cars	192.56	43.08	64.90	300.54	390.28
%	71.84	82.74	74.14	73.73	75.65

COST OF EMISSION STANDARD, RM

	CONVERS. MILL VEH	COST/VEH RM	COST/VEH PA, RM	COST,PA MIL RM	COST/T PA, RM	COST/TW PA, RM
Cars	1.892	1600	260	492.66	-	-
Maint. cost	-	-	125	236.50	-	-
Fuel cost	1.892	-	-113	-213.80	-	-
Total cars	-	-	-	515.3668	1715	1321

B) EMISSION STANDARDS FOR MOTORCYCLES

1990 MALAYSIA 1990, T

	CO	HC	NOX
# Motorc., '000			
KM/Year			
Total KM, Mill			
Share 2-stroke			
KM 2-stroke, M			
KM 4-stroke, M			

2000		MALAYSIA 1990 E. FACTORS			NON-CAT CONTROLS			CATALYST CONTROLS		
		CO	HC	NOX	CO	HC	NOX	CO	HC	NOX
# Motorc., '000	3243	0.04	1.8	4.7	-	-	-	-	-	-
KM/Year	12000	-	-	-	-	-	-	-	-	-
Total KM, Mill	38916	-	-	-	-	-	-	-	-	-
Share 2-stroke	0.5	-	-	-	-	-	-	-	-	-
KM 2-stroke, M	19458	330786	192634	1459	233496	27241	5837	97290	5837	5837
KM 4-stroke, M	19458	233496	97290	9729	233496	27241	5837	97290	5837	5837
Sum	-	564282	289924	11188	466992	54482	11675	194580	11675	11675
Reduction	-	97290	235441.8	-486.45	-	-	-	-	-	-
% Reduction	-	20.83	432.14	-4.17	-	-	-	-	-	-

Sum Pollutants	865394.5	533149	217929.6
Reductio		332245.3	647464.9
% Reduction		62.32	
Reduction, Index		425400.5	297.10
% Reduction			513350.6

COST OF EMISSION REDUCTION - MOTORCYCLES, 2000

	RM MILL	MRM, PA	T RED	RM/T, PA	T RED	INDRM/T, INDX
Non-Cat Controls						
Fuel Cost	0	-	-	-	-	-
Control Equipment	568	117	-	-	-	-
Total Cost, MRM	568	117	332245	351	425401	274
Catalyst						
Fuel Cost	88	-	-	-	-	-
Control Equipment	811	167	-	-	-	-
Total Cost, MRM	899	254	647465	393	513351	496

Appendix IV.6

Cost-Effectiveness of Fuel Price Increases

		PRICE ELASTICITY OF 20%				PRICE ELASTICITY OF 40%			
	BAU[a]	SIM1	SIM2	SIM3	SIM4	SIM1	SIM2	SIM3	SIM4
FUEL CONSUMPTION 1990, T	4732443								
GASOLINE	3040918								
DIESEL	1691525	6321326	5263676	76					
FUEL CONSUMPTION 2000, T	7901135	6321326	5263676	7634748	7083841	4740995	3030641	7365177	6266547
GASOLINE	4710522	3768627	3764153	4498908	4496686	2826470	2819416	4287281	4282850
DIESEL	3190613	2552700	1499523	3135840	2587155	1914525	211225	3077895	1983697
% CHANGE		-20	-33	-3	-10	-40	-62	-7	-21
GAS		-20	-20	-4	-5	-40	-40	-9	-9
DIESEL		-20	-53	-2	-19	-40	-93	-4	-38
EMISSIONS 1990, T	631464	631464	631464	631464	631464	631464	631464	631464	631464
EMISSIONS 2000, T	964389	795539	745251	953839	927666	596654	515368	913178	860984
REDUCTION		168850	219138	10551	36723	367735	449021	51212	103406
% REDUCTION		17.51	22.72	1.09	3.81	38.13	46.56	5.31	10.72
DENSITY: KG/L									
GASOLINE	0.72								
DIESEL	0.85								
DUTY 1990, RM/T									
GASOLINE	366								
DIESEL	97								
PRICE 1990, RM/T									
GASOLINE	814								
DIESEL	553								
PRICE 2000, RM/T									
GASOLINE	814	1627	1627	996	996	1627	1627	996	996
% CHANGE		100.00	100.00	22.48	22.48	100.00	100.00	22.48	22.48
TOTAL DUTY, RM/T									

GASOLINE		1992.96	1992.96	1362.24	1362.24	1992.96	1992.96	1362.24	1362.24
DIESEL		649.91	1392.3	144.84	621.76 43	649.91	1392.3	144.84	621.76 43
LOSS CONSUMER SURPLUS, RM MILL		560	1481	21	178	1119	2700	41	356
GASOLINE		383	385	19	20	766	769	39	39
DIESEL		176	1096	1	158	353	1930	3	317
COST-EFFECTIVENESS, RM/T		3315	6756	1959	4848	304	6012	809	3443
US$/T		1326	2703	784	1939	1218	2405	324	1377
TAXES 1990, MIL RM	1275.58								
GASOLINE	1112.25								
DIESEL	163.33								
TAXES 2000, MILL RM	2031.01	6104	6527	2922	4076	4578	3619	2798	3583
GASOLINE	1722.92	4445	4439	2468	2467	3333	3325	2352	2350
DIESEL	308.09	1659	2088	454	1609	1244	294	446	1233
TAX CHANGE '90, %	59.22	378	412	129	220	259	184	119	181
TAX CHANGE BAU, %		201	221	44	101	125	78	38	76

*: BAU is identical to the scenario in section C and assumes no fuel price changes.

Source: World Bank Calculations.

V. URBAN SERVICES

A. Introduction

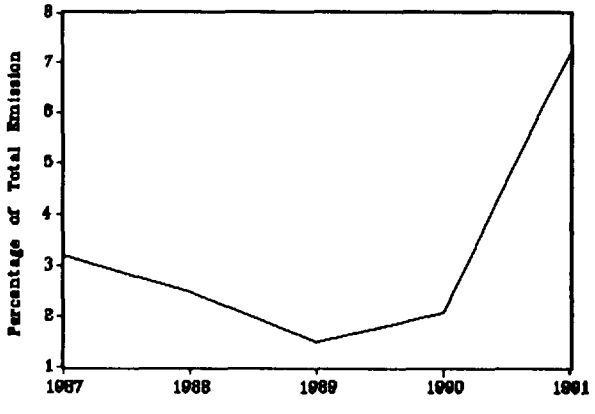
5.1 The focus in this chapter is on urban services, such as the provision of clean drinking water, sewerage and solid waste treatment and disposal that are crucial in determining the quality of urban environment. The increase in incomes, urbanization and industrial output has considerably stretched the Government's ability to continue providing these services -- both financially and in terms of personnel. For example, with regard to the financial burden, it is estimated that total investment needed for running services at acceptable standards is between US$12-14 billion. However, given the commitment to fiscal prudence, it is difficult for the Government to allocate such large resources. It is also questionable whether Local Authorities, that currently provide most of the services, have the financial and technical capability to meet additional demand.

5.2 This chapter consists of seven parts. The current coverage and adequacy of services is discussed in B; Problems of efficiency and design in the delivery systems, demand projections and a comparison of investment needs with actual allocations are presented in C. The problems of continued delivery of services by Local Authorities are examined in D followed by a discussion of the privatization option in E. F presents the results of an illustrative willingness-to-pay survey. Finally, G summarizes the findings and presents the main recommendations.

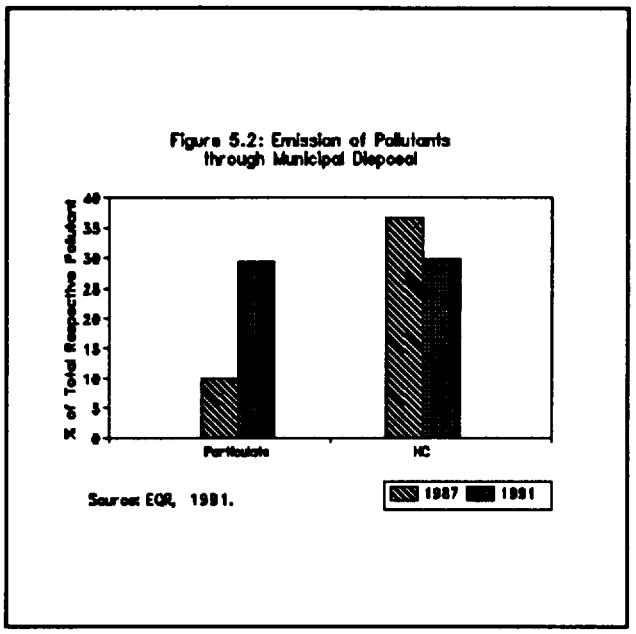
5.3 Human waste in urban areas affects the environment in three ways. It pollutes the air when solid waste is burned openly; it contaminates drinking water when inadequately treated sewage and leachates seep into the drainage system and it results in insect-borne diseases when sanitation is poor.

5.4 The Department of the Environment estimates that open burning of municipal solid waste (mostly by scavengers) contributed 7.2 percent of the emissions causing air pollution in 1991. (The problem is more severe in locations such as Mulu Langat, Petaling Jaya, Shah Alam and DB Kuala Lumpur that have a large number of sites where municipal waste is burnt openly). This is twice the emission levels of five years ago (see Figure 5.1). Particulate matter and hydro carbons are the principal constituents of pollution from this source: Particulates have increased nearly sixfold between 1987-91, while hydrocarbon emissions have come down slightly (see Figure 5.2).

Figure 5.1: Total Emission of Air Pollutants through Municipal Disposal

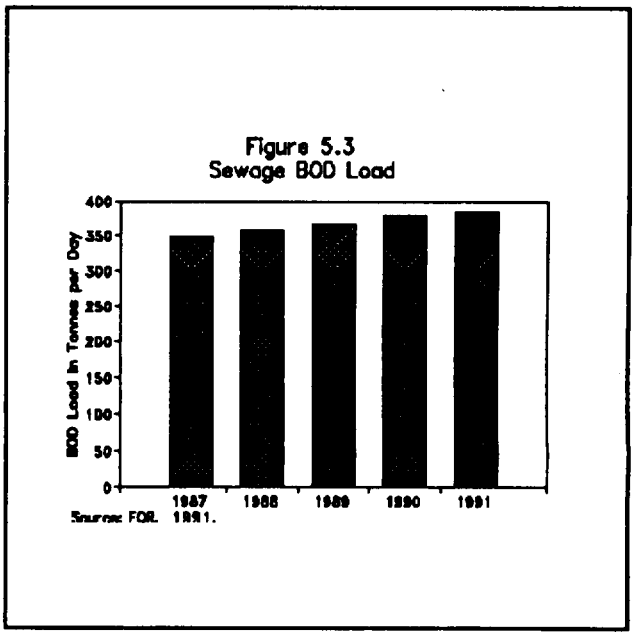


Source: EQR, 1991.



5.5 Water pollution is the most serious environmental consequence of inadequate treatment of human waste. The BOD discharge of sewage in Malaysia was estimated at 385 tons per day in 1991. Accounting for 79 percent of the pollution, this was by far the largest source compared to industry and agriculture (Table 5.1). And, as the urban population continues to grow, sewage-related water pollution remains a major problem (Figure 5.3).

5.6 Sewage in BOD discharge seeps into the drainage system and ultimately affects the quality of river water. According to DOE surveys, the presence of BOD accounts for most of the deterioration in the quality of river water in Malaysia: Between 1986-91, the quality improved in 25 rivers but deteriorated in 39, which is illustrates the difficulty of keeping up with increased human waste disposal in urban areas (Table 5.2).



5.7 The deterioration due to human waste was corroborated by two other surveys: In the surveys conducted between 1987-89 for its Drinking Water Quality Surveillance Program, the Ministry of Health reported fecal coliform presence in 3 to 5.7 percent of the samples. Further, in its 1990 report on the performance of 37 water quality treatment works in Johor, the World Bank stated that 50 percent of the systems did not comply with the bacteriological standard for both E.coli and coliform bacteria.

5.8 Contaminated water and waterborne diseases such as cholera, typhoid dysentery and hepatitis are closely related. Chapter I showed there are substantial benefits from interventions that reduce the incidence of such disease. Perhaps the most important of these are improving the quality of urban services, such as supply of clean drinking water and proper treatment and disposal of sewerage and municipal solid waste.

Table 5.1: Organic Pollution Load Discharged According to Sector, 1987-1991

Sector	*1987*		*1989*		*1991*	
	BOD Load[1]	*Population Equivalent*[2]	*BOD Load*	*Population Equivalent*	*BOD Load*	*Population Equivalent*
Agro-base Industries	11	0.22	11	0.22	12	0.24
Manufacturing Industries	20	0.40	21	0.42	25	0.50
Agriculture (Animal Husbandry)	55	1.10	60	1.20	65	1.30
Population (Sewage)	348	6.96	366	7.32	385	7.70
Total	434	8.68	458	9.16	487	9.74

Source: Department of Environment, Environmental Quality Report 1991

Note: [1] BOD Load in tones/day.
[2] Population equivalent (in million) calculated on the assumption of 54 grams of BOD generated per person per day.

Table 5.2: Status and Trend of River Water Quality, 1986-1991

Index	*Status*		
	Clean	*Slightly Polluted*	*Seriously Polluted*
General	37	44	6
BOD_5	65	17	5
Ammoniacal Nitrogen	35	26	26
Suspended Solids	18	17	52

Source: Department of Environment, Environmental Quality Report 1991

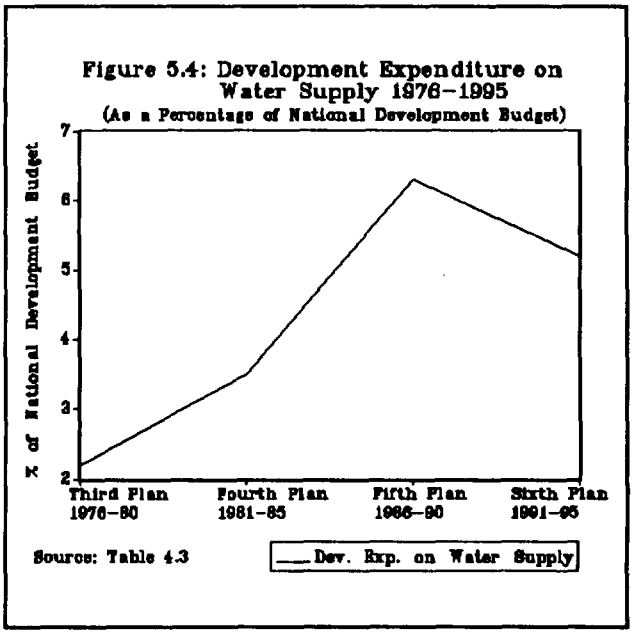
B. Coverage and Quality of Urban Services in Malaysia

Water Supply

5.9 Clean and convenient water supply has been a priority in Malaysia for several decades and with abundant and reliable precipitation, the many river systems have provided relatively easy access to clean water. The demand for domestic and industrial water supply in 1980 was 1.3 billion m^3. However, with the rapid pace of industrialization and income growth, demand increased substantially in 1990.

5.10 In Malaysia's federal structure, land and water resources are owned by the states. However, the federal government extends loans to the states for investments to develop these resources. Thus whereas water works are owned and run by the state governments, the federal governments invests mainly in their expansion and in improving the quality of the service.

5.11 Development expenditure on water supply increased threefold between the Third and the Fifth Plans; the Sixth Plan has allocated US$1.2 billion, or 5.2 percent of the national development budget, to the sector (see Table 5.3 and Figure 5.4).



5.12 Adequate investment in successive plan periods has enabled Malaysia to successfully meet its citizens' drinking water requirements (Figure 5.5). By 1995, urban drinking water needs should be fully met in the states of Melaka, Perlis, Penang, Sabah, Sarawak and Selangor (Table 5.4a). For the remaining, coverage should be 95 percent or more except for the large mountainous state of Kelantan where 85 percent of the urban population will have access to safe water by 1995. The confidence that these targets will be met is based on the Government's past performance in utilizing investment allocations: Between 1985-90, coverage increased by 3 percent overall and the sixth plan allocation will meet the targeted overall increase of 2 percent. In the rural areas where 79 percent of the population are to be covered (only 51 percent in Kelantan), the figure is lower than in urban areas but it is increasing steadily (a targeted increase of 22 percentage points in the 10-year period 1985-1995).

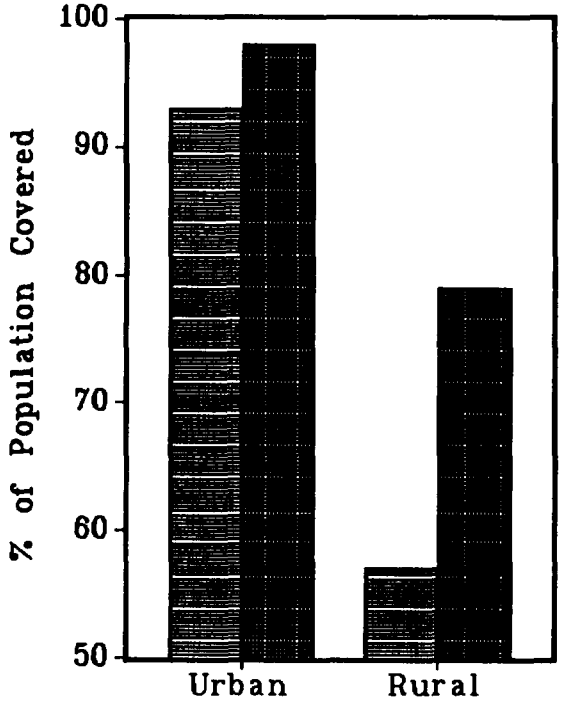
Table 5.3: Development Expenditure on Water Supply 1976-1995

Five Year Plan	*Period*	*Expenditure US$ million*	*Percentage of National Development Budget*
Third Plan	1976 - 80	233	2.2
Fourth Plan	1981 - 85	834	3.5
Fifth Plan	1986 - 90	880	6.3
Sixth Plan	1991 - 95	1,142[1]	5.2

Source: Sixth Malaysia Plan

[1] *Planned.* Actual expenditure during Fifth Plan was 91% of the amount planned.

Figure 5.5: Increase in Water Supply Coverage



Source:
Table 4.4a,
Table 4.4b.

1985 1995

Table 5.4a: Urban Water Supply Coverage By State, 1985 - 1995

	1985		1990		1995	
	PERSONS	%	*PERSONS*	%	*PERSONS*	%
Johor	673,992	92	888,960	96	1,145,473	97
Kedah	175,275	95	212,915	97	257,838	98
Kelantan	199,355	65	261,096	69	399,670	85
Melaka	114,800	100	126,400	100	139,200	100
N. Sembilan	207,904	89	256,880	92	345,504	96
Pahang	241,965	95	272,930	98	301,056	98
Perak	625,730	98	700,920	99	784,575	99
Perlis	15,252	93	20,273	97	26,900	100
P. Penang	556,934	98	697,158	99	881,100	100
Sabah	292,900	100	392,800	100	540,700	100
Sarawak	283,765	95	353,856	96	450,500	100
Selangor	1,892,400	95	2,478,714	98	3,266,200	100
Trengganu	255,000	85	350,010	90	481,555	95
Total	5,535,272	93	7,021,912	96	9,020,271	98

Source: Malaysian National Conservation Strategy, Background Paper on Freshwater Resources, 1992

Table 5.4b: Rural Water Supply Coverage by State, 1985 - 1995

STATE	*1985*		*1990*		*1995*	
	PERSONS	%	*PERSONS*	%	*PERSONS*	%
Johor	687,836	61	792,342	67	936,546	78
Kedah	579,623	58	768,758	67	963,732	77
Kelantan	216,900	30	316,080	40	433,347	51
Melaka	311,108	82	375,030	90	441,392	98
N. Sembilan	295,425	75	335,495	85	370,215	95
Pehang	485,745	65	594,160	70	774,595	79
Perak	937,800	72	1,084,278	78	1,212,796	83
Perlis	74,600	50	108,030	65	145,680	80
P. Penang	412,250	85	436,608	96	370,440	98
Sabah	381,710	38	594,152	52	1,002,800	80
Sarawak	414,447	33	656,731	47	1,145,150	74
Selangor	724,671	73	833,000	85	715,528	94
Trengganu	135,560	40	195,199	53	241,280	65
Total	5,675,684	57	7,089,863	66	8,753,501	79

Source: Malaysian National Conservation Strategy, Background Paper on Freshwater Resources, 1992

5.13 International comparisons portend that investments in urban water supply will continue to be a priority in Malaysia. Table 5.5 shows that Malaysia's high urban coverage is similar to other countries at its level of development, but also that urbanization in Malaysia is relatively low. In the future, the need for greater investment in clean drinking water will arise on account of three factors: one, demand will rise as the pace of urbanization picks up with further modernization of the economy; two, income growth in itself will increase demand via improvement in the quality of housing stock; and three, rapid industrialization and urbanization increases the point sources that contaminate the water system, so that more investment will be needed in the future to maintain the quality of drinking water.

Table 5.5: Level of Service in Urban Areas, 1990

	Urban population %	*Drinking water* %	*Sanitation* %	*Water charge per m³* US$	Total employee per million population served
Philippines	43	93	79	0.17	53
Thailand	-	-	-	-	-
Malaysia	41	96	72	0.17	-
Mexico	71	94	85	0.44	-
Brazil	76	95	84	0.13	837
Korea	71	100	67	0.27	363
Americas	70	90	82	-	-
South East Asia[1]	26	73	-	0.18[2]	-

Source: International Drinking Water Supply and Sanitation Decade (as at December 1990). WHO August 1992

[1] Excluding China
[2] Excluding the Maldives, cost per m³ is US$ 5.88

Sewerage and Sanitation

5.14 Large urban concentrations and industrialization are relatively recent in Malaysia and sewerage and sanitation have become a serious issue only in the last 10-15 years. The responsibility for providing the services rests with the local government authorities (LGA) who receive minimal Federal funding to invest in new facilities. Table 5.6. shows that development allocations for sewerage have not exceeded 1 percent of total development expenditure in Malaysia in the 20-year period, 1976-1995.

5.15 Lacking adequate revenues, the LGAs have coped with increased demand by requiring housing developers to provide primary treatment sewerage facilities within their individual subdivisions. Once treated, the effluent from LGA facilities and the new housing schemes and treatment ponds is discharged into the drainage system. The problem is that the budgetary allocations to the drainage system have been even more modest than to sewerage; between 1976-1995, they will not have exceeded one percent of total investment allocations.

5.16 The drainage and sewerage network together constitute the sanitation system in Malaysia; and the evidence is that the system is inadequate. Due to financial parsimony and institutional weakness there is a huge and rapidly growing demand for sanitation that is unmet (contaminated water seeps from open ponds into the underground water and rivers) and poses a threat to the quality of drinking water and the urban environment. Table 5.7 shows the distribution of sanitation facilities in Malaysia the growth of such facilities, in the last two decades, and the pressing need for more. For example, in 1990, only about 5% of the urban population was on central sewerage systems, concentrated mainly in Kuala Lumpur and a few urban centers on the west coast,

while another 47% was served by communal systems that treat the effluent in oxidation ponds, Imhoff tanks or individual septic tanks. These latter three are less effective than the central system but still better than pour flush latrines that serve about 20 percent of the urban population and the remaining 28 percent which have inadequate or no facilities at all.

Table 5.6: Development Expenditure on Sewerage 1976-1995

		Sewerage		Drainage and Storm Drains	
Five Year Plan	*Period*	*Expenditure US$ million*	*Percentage of National Development Budget*	*Expenditure US$ million*	*Percentage of National Development Budget*
Third Plan	1976 - 80	28	0.3	n.a.	n.a.
Fourth Plan	1981 - 85	84	0.6	6	0.0
Fifth Plan	1986 - 90	23	0.2	57	0.5
Sixth Plan	1991 - 95	220[1]	1.0	147	0.7

Source: Sixth Malaysia Plan

[1] Planned. Actual expenditure during the Fifth Plan was 82% of the planned.

Table 5.7: Population Distribution by Type of Sanitation Facility

Type of Facility	*1970 Census*	*1980 Census*	*1990 Estimate*
Adequate Service			
Central Sewerage System	3.4	4.0	5.3
Flush Toilet to Septic Tank or Local Treatment	16.0	21.8	47.0
Pour Flush	2.6	30.3	20.0
Inadequate Service			
Bucket Latrine	17.1	7.7	4.4
Pit Latrine	27.8	15.3	8.5
Latrine over Water Body	33.1	4.5	4.8
No Facility		16.4	10.2

Source: Housing Census 1970 and 1980, Dept. of Statistics and Estimate by Ministry of Housing and Local Government

Municipal Solid Waste

5.17 Malaysia's urban residents generate solid waste at the rate of between 0.5 and 0.8 kg/person/day, (Table 5.8), a figure that is akin to countries at similar levels of development. At this rate, 6.05 million urban residents in Peninsular Malaysia in 1988 produced 1,458,000 million tons of solid waste; of this, 1,240,000 tons (or 6.2 million cubic meters) were collected and disposed of, giving a collection efficiency of 85%.

5.18 The composition of urban solid waste is reported in Table 5.9. The largest constituents are organic/vegetable materials and paper and cardboard, followed by plastics and metal, also similar to those found in countries at a similar level.

Table 5.8: Per Capita Generation of Waste

Municipal Council	*Petaling Jaya*	*Kuala Trengganu*	*Malacca*	*Penang*	*Ipoh*	*Kota Star*	*Kota Bahru*
Served Population	300,000	117,000	220,000	494,000	404,000	178,000	157,000
Amount Collected (t/month)[1]	7,590	2,100	5,000	10,533[2]	6,000	4,200	2,400
Per Capita Generation Rate (kg.person/day)	0.8	0.6	0.8	0.7	0.5	0.8	0.5

Source: Ministry of Housing and Local Government, Action Plan for a Beautiful and Clean Malaysia (ABC), June 1988

[1] Estimate by the municipalities
[2] Measured

Table 5.9: Solid Waste Composition
(Percentage by Weight)[1]

	MHLG Survey		*DOE Survey*			
	Petaling Jaya	Kuala Trengganu	Kuala Lumpur	Malacca	Penang	Klang
Organic/Vegetables	48.3	66	51	57	41	44
Paper and Cardboard	23.6	11	28	28	31	27
Plastics	9.4	3.5	8	11	12	8
Textiles	4.0	1	2	1	4	3
Wood	4.8	-	3	6	5	10
Glass	4.0	5	3	1	3	3
Metal	6.0	11.5	5	6	4	5
Bulk Density Kg/m^3	172	225	286	174	194	204

Source: ADB, Malaysia Water Supply and Sanitation Sector Profile, 1986

[1] Data from reports and surveys during 1984 to 1987.

5.19 Collection and disposal of municipal solid waste are the responsibility of local government authority (LGA). Together with cleaning of streets and public areas, municipal waste accounts for 28% of the municipalities total expenditures. The district councils spend 51 percent of the expenditure on these service, which is substantially higher. Based on information collected by the mission, it is estimated that Kuala Lumpur Municipality spent RM 25.2 million (US$10 million) in 1991 to service its solid waste, which is equal to five percent of its total budget of RM 502 million (US$201 million) or 46 percent of the cleansing department's total expenditure (see Table 5.10). The annual cost per capita in the serviced areas was RM 17 (US$6.8). The 1988 estimates indicate a cost per capita range of RM 9 and 14 (US$3.6 and 5.6) across different municipalities.

Table 5.10: Kuala Lumpur Municipal Cleaning Expenditures - 1991

Activity	*Expenditure Ringgit*	Percentage
Administration	1,026,500	1.8
Grass cutting	7,137,000	13.1
Cemetery and grave services	892,500	1.7
Public ablution facilities	1,156,200	2.2
Waste collection	23,090,000	42.3
Waste disposal	2,209,600	4.0
Street sweeping	18,925,000	34.7
Total	54,436,800	100.0

Source: Kuala Lumpur Municipality, Cleansing Department, Annual Report 1991

5.20 Solid waste is often collected either by municipal workers or contracted private operators who are generally paid a monthly fee per house served. Contractors service, on average, 600 housing units per day, while the municipality's large compactors service about 400 houses daily and the small compactors about 200. In several municipalities, residential collection is done every second day, while from shops it occurs on a daily basis. Kuala Lumpur Municipality pays the collecting contractors RM 3 per flat (apartment), RM 3.5-4.0 per terraced house, RM 4.0-5.0 per semi-detached house, RM 4.5 per bungalow and RM 10 per shop. The municipality estimates its direct collection costs to be about 20% higher than what it pays to private contractors. Vehicles manage an average of two trips per day with distance to the landfills of 15 km. Costs in Johor Bahru were found to be similar to those in Kuala Lumpur.

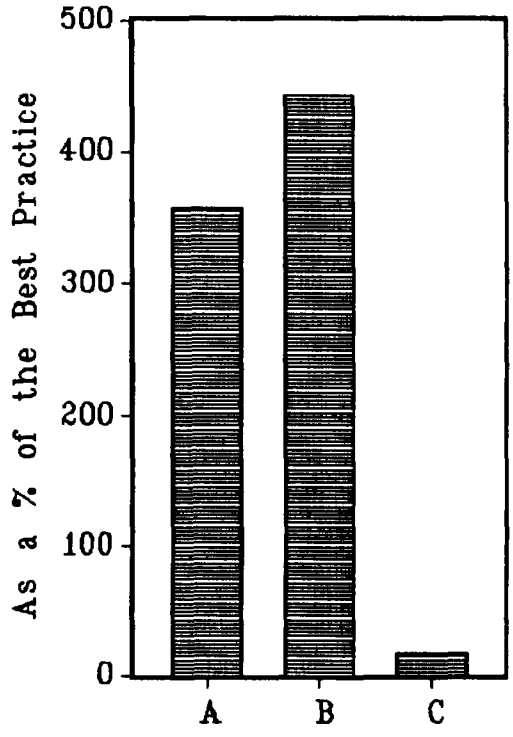
C. Efficiency Issues and Emerging Problems

Water Supply

5.21 Higher Water Tariff. There is good potential for cost recovery in the delivery of water is high in Malaysia. Currently, Malaysia charges its water consumers US$0.17 per cubic meter, which is two-thirds of the charge in Korea (Table 5.5). Given daily water supply of 4.98 million cubic meters in 1990, this yields US$309 million as annual revenue from water charges. Increasing the water charges to the levels of Korea i.e. raising the charge to US$0.23 per cubic meter, would increase revenues to US$418 million, which is equal to the investment needed to improve the service (see Table 5.12 on estimated financial gaps and targeted service improvement). Thus, higher water charges would allow the country to fund future investment needs and thus alleviate the financial burden on the Government.

5.22 Productivity Improvement. The potential for lowering water delivery costs through productivity improvements is also quite high. Figure 5.6 (based on Table 5.11), which compares Johor and Penang productivity performance with five well-run regional companies in Latin America, five companies from Europe, USA, and Canada shows that Malaysia scores poorly on productivity performance indicators A (i.e. Malaysia's ratio of employees per thousand people is three and a half times the level in Canada) and B (Malaysia ratio of employees per thousand water connections is over four times higher than the best practice). Regarding productivity indicator C (thousands of cubic meters billed per employee), Malaysia again score poorly at less than 10 percent of the best practice. Furthermore, Table 5.11 shows that Canada leads the world in productivity in water delivery on most criteria. Malaysia would do well to learn from Canada's success in moving towards an efficient clean water delivery system.

Figure 5.6: Water Supply Personnel Productivities



Source: EQR, 1991.

A Employees/1000 Population served.
B Employees/1000 Water connections.
C M^3 Billed/Employees (000 M^3/year)

Table 5.11: Water Supply Productivity Indicators 1987

Company	*Total Employees*	*Employees/1000 Population Served*	*Employees/1000 Water Connections*	*m^3 Billed/ Employee (000 m^3/year)*	*Personnel Cost/ Operating Cost (%)*
Malaysia					
Johor (1991)	1875		4.6	51	n.a.
Penang (1988)	1164	1.18	7.8	93	n.a.
Latin America					
A	6799	0.97	5.4	58	41
B	2628	0.62	3.5	114	39
C	2326	1.24	4.1	146	31
D	1770	0.65	2.2	86	40
E	411	0.98	6.8	53	42
Average			4.7		
Brazil	80296	1.33	3.1	63	54
Europe					
F	1569	0.54	1.5	137	n.a.
G	1077	0.38	1.6	1313	30
H	177	0.53	1.1	170	31
I	232	0.46	4.5	200	22
USA	60055	0.58	2.9	368	n.a.
Canada	1744	0.33	2.0	424	n.a.

Source: Penang Water Board, Johor Water Department and World Bank Discussion Paper, Report INU 61

5.23 Providing for Future Demand. The urban population is projected to increase from 7.3 million in 1990 to approximately 13.5 million by 2010. Increasing the coverage of piped water supply from 96% in 1990 to the targeted 100% by year 2010 would mean providing treatment and distribution facilities to 6.4 million additional consumers; and they would require investments of around US$12.9 billion. In fact, these estimates will need to be revised upwards because unit costs of water supply will increase for two reasons: (a) future expansions will involve developing new and more remote sources and (b) connections to users in more outlying urban areas will increase.

5.24 Allocations in the Sixth Plan, given projected investment needs, will not be adequate. The plan earmarks RM 2,855 million (US$1,142 million) to the sector, of which RM 350 million (US$140 million) is for rehabilitating existing treatment works and RM 787 (US$315 million) for developing the

reticulation networks. The total annual allocation (approximately US$220 million a year) to the sector, is just a third of the amount needed, given long-term projected consumer demand (see para above).

5.25 Thus, the government is actively exploring the possibility of the urban water supply being provided by the private sector, which would invest the capital needed. Johor State is planning to turn its water department into a privately owned company by January 1994 including the training center at Sungai Layang. Unfortunately, GOM has not yet given an estimate of the planned investment by the private sector nor information on how the private and public sector investments are expected to supplement each other.

Sewerage

5.26 Poor Service. The present sewerage disposal system relies predominantly on individual septic tanks, Imhoff tanks and communal oxidation ponds that provides only primary and, at best, secondary treatment to the effluent, which is then flows into soak pits, fields or directly to drains and streams. Some of the effluent is filtered through the soil, but most of it eventually finds its way into the water courses through the drainage systems. For this sewerage system to function properly, all the tanks, ponds and drains must be maintained through regular desludging, disposing of the sludge and allowing the drains. However, Government surveys show that no LGA operates a regular desludging program, that tanks are desludged an average of once every 10 years and generally only when owners have problems with them. In addition, several oxidation ponds have never been desludged and sludge from water treatment plants and septic tanks is often dumped on nearby vacant land. This practice threatens to contaminate the water and is a serious environmental hazard.

5.27 Clearly, there is a pressing need to improve the design of the treatment systems as well as to develop an adequate drainage system. This would require investments in physical infrastructure as well as in staff, since the agencies involved need the proper mix of administrative and technical skills to run the system efficiently.

5.28 Well designed and maintained septic and Imhoff tanks can reduce water pollution in the form of biological oxygen demand (BOD) by as much as 50 percent; but, this has little impact on disease-causing pathogens. However, properly designed oxidation ponds complemented by well designed and maintained drainage system would, in the climatic conditions prevailing in Malaysia, greatly reduce both BOD loads as well as pathogens.

5.29 As in the case of water, future demand for sewerage is also not adequately provided for. Because hard information on future sewerage needs is not available, the assessment of future needs made in this report is based on assumptions following discussions with various Government agencies. Thus, it is assumed that by the year 2010, all new urban areas will have access to adequate sewerage treatment (and no improvement is made in service to existing areas), 6.1 million new connections would be required at cost of US$5.7 billion, and the

population covered would have increased from 52 percent in 75 percent. To provide 100 percent coverage in all urban areas, US$8.9 billion of investment would be needed.

5.30 Malaysia's Sixth Plan has allocated RM551 million for sewerage development in the 1990-1995 period. This is only 39 percent of the annual investment needed to cover 3/4 of the population, and just 25 percent if the goal were universal coverage.

5.31 Moreover, investments under the Sixth Plan have largely been halted, while the Government reviews a proposal by a private consortium for privatizing the urban sewerage systems, with a planned investment of RM 6 billion over 18 years and an operational franchise of 28 years. The Government seems interested in a nationwide project and is presently reviewing proposals to develop national coverage. (The privatization proposal is discussed in more detail in section E of this chapter).

Solid Waste

5.32 The environmental problems associated with solid waste stem mainly from its improper disposal: At present, none of the 230 official dump sites are environmentally safe. Further, although operators are discouraged from burning the waste, open burning is common, and the DOE has been receiving an increasing number of complaints. The sites are not formally monitored; thus, the leachate from the dumps flows into rivers and ground water. Moreover, the city's two active dumps will filled to capacity in 1994. A proposal to establish a sanitary landfill for Kuala Lumpur and Selangor state was presented about two years ago and negotiations are still underway.

5.33 With assistance from the Japan International Cooperation Agency (JICA), a plan for solid waste management was prepared under the auspicious name of Action Plan for a Beautiful and Clean Malaysia (ABC). However, although detailed plans have already been made for Kelang Valley and Penang, no central Government investment has materialized and only limited Federal funding has been provided to the LGAs for investment. MHLG has distributed weighbridges to some municipalities that were interested in collecting data on the quantity of municipal waste to plan their solid waste programs better. Pilot recycling programs have also been initiated. The ABC appears to be well-conceived and deserves to be properly funded to bring results.

5.34 The amount of waste generated in urban Malaysia is expected to increase from an average of 0.66 kg/cap/day in 1988 to 0.9 kg/cap/day by 2010, for a total of 2.4 million tons/year (an additional 12.8 million m^3 of waste would be generated). To meet this demand, investment in developing sanitary landfills is estimated at US$70 million (RM175 million), and transfer stations and transfer vehicles would be additional. The investment stream would be US$3.5 million a year which is fairly close to the estimate of US$3.1 million in the ABC program. (The Action Plan for Beautiful and Clean Malaysia (ABC program) has a time horizon of eight years and allocates US$25 million). In the Sixth Malaysia Plan the government has allocated RM 22.5 million to develop selected landfills throughout the country. This is just a fraction of what is needed.

5.35 Fixed investment needs for developing sanitary disposal dumps are relatively modest compared to the high annual operating costs of handling municipal waste (mostly for salaries), estimated at US$86 million. This amount appears high by international standards and suggests that efficiency gains can be made by adopting measures to enhance productivity.

5.36 To summarize, in addition to problems of coverage and efficiency in the delivery of services, overall public investment allocations to urban services appear inadequate. Taking all services together, Sixth Plan allocations consistently fall short of estimated future investment needs to upgrade urban services and avoid environmental degradation. The annual investment gaps are shown in Figure 5.7, which is based on Table 5.12.

Figure 5.7: The Investment Gap in Urban Services (Annual) 1990-1995

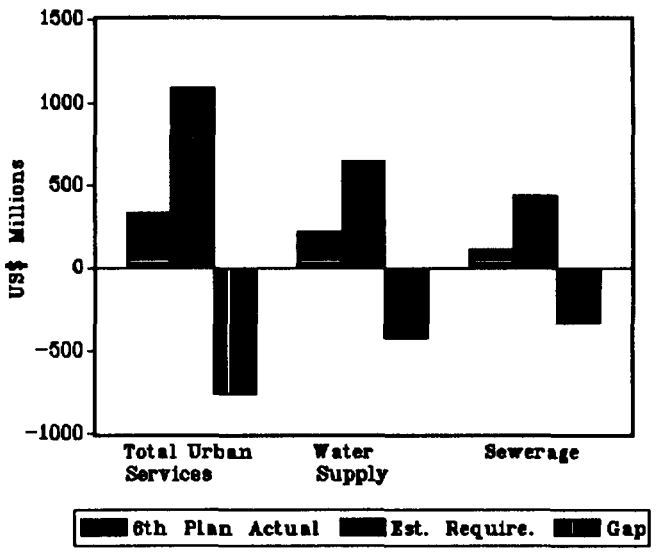


Table 5.12: Future Investment Needs and Actual Allocations
(Millions of US$)

	Service level % coverage	*Additional population by 2010 mill.*	*1990 level of service*	*Improved service (*)*	*Estimated annual req invest. for (*)*	*Sixth Plan annual allocation*	*Annual investment gap*
Water supply	100	6.434	11361	12903	645	220	-425
Sewerage							
a.	74	6.141	5680	-	-	-	-
b.	100	9.947		8930	445	110.5	-334.5
Total	-	-	17041	21338	1190	330.5	-759.5

Sources: Sixth Malaysia Plan and Bank Staff estimates.

D. Local Authorities in Urban Pollution Abatement

5.37 The financing gap and inadequate provision of urban services result from the overall weaknesses of local authorities in Malaysia.

5.38 Collection and disposal of urban solid waste and sewerage are traditionally the responsibility of local authorities in most developed and developing countries. In Malaysia, these services command the lion's share of LA budgets and are a severe strain on their limited skilled personnel. Increasingly, therefore, policy makers question whether LA's should continue to provide these services in light of the large investment outlays and skilled personnel that will be needed. The following discussion reviews the financial and administrative capabilities of LA's in Malaysia to draw conclusions on whether they can be rejuvenated to shoulder the new responsibility. The alternative would be to privatize sewerage and thus enable the LA's to focus more on the other essential services they provide, including monitoring and enforcement of regulation for sewerage and other forms of urban pollution.

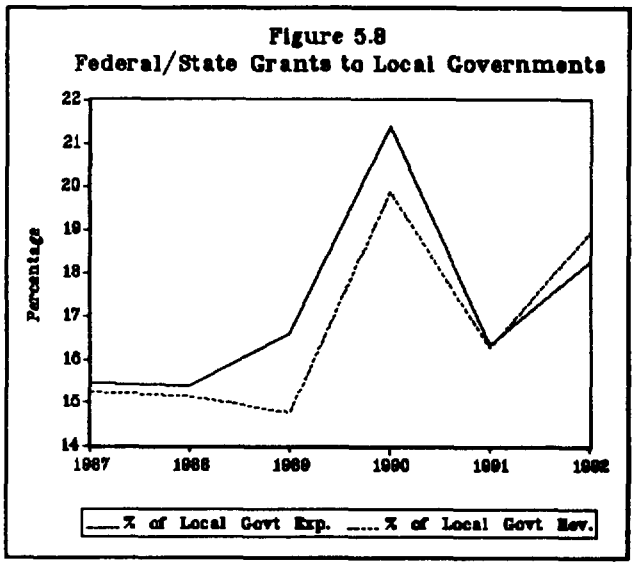
Malaysian Local Authorities

5.39 There are 96 local authorities in Peninsular Malaysia of which one is the City hall and 15 are municipal councils and 79 are district councils. Some of the more developed states (Penang, Perak and Slangor) have more than one municipal council, corresponding to the number of developed urban centers. The municipal authorities perform many functions such as removal and disposal of garbage and night soil, sanitation and town cleaning, prevention of littering and abatement of nuisance, food and hygiene, control of rodents, pests and disease bearing insects, provision and maintenance of public places and recreational facilities, street lighting, and establishment and maintenance of public places and burial grounds. For those municipal authorities that provide the service, 10% of the budget is allocated to sewerage and another 30 percent to garbage collection and disposal. Thus many of the aspects in urban and industrial pollution, ie sewerage and sanitation, abatement of hazardous waste and other forms of localized industrial pollution fall directly in the ambit of local authorities.

5.40 How well the LA's perform these functions is related to (i) their financial health, (ii) their constitutional autonomy in implementing changes and (iii) their administrative and technical capacity. It is broadly agreed in Malaysia that with the exception of the Kuala Lumpur City Hall, the Petaling Jaya municipal council, the Penang Municipal Council and the central Melacca municipal council, the LA's are financial distressed and administratively weak. Therefore, without a major overhauling, it is unrealistic to expect them to shoulder the increased responsibility of setting and enforcing standards of a clean industrial and urban environment.

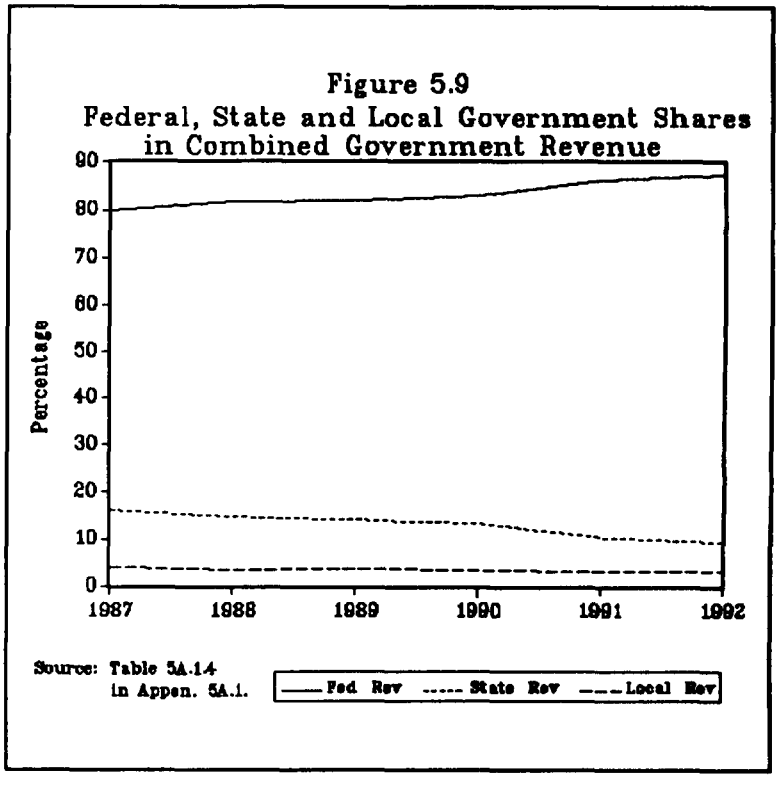
The Financial Dependency of LA's.

5.41 The revenue position of the LA's is weak and they rely on a large number instruments, each yielding a low revenue amount. The main revenue source is the collection of assessments on properties in their jurisdiction and the fees for services they render to the public. These revenues are inadequate given the expenditures, so that the LA's are heavily dependent on state and federal government grants and loans (Figure 5.8).



5.42 The financial dependency of the LA's is rooted in the constitution which places LA's under the aegis of the states to which they belong, except for the federal territory of Kuala Lumpur, which falls under the Prime Minister's Department. The Local Government Act of 1976 has further strengthened the hold of state governments over their L.A's, reducing their constitutional and financial autonomy.

5.43 The Malaysian constitution makes the federal government the predominant player in the public revenue system. The federal government's revenue sources are income tax and taxes on property and capital gains, international trade, production and consumption as well as stamp duties and other minor taxes. The federal government also receives non-tax revenues from several sources. State governments receive revenues from taxes on forests, lands and mines, customs and excise (Sabah and Sarawak only) entertainment duties and other minor taxes. Altogether, these account for 59.6 percent of their revenues; non-tax revenues account for the other 40.4 percent. Because of its much larger tax base, federal government revenue has averaged 83.6 percent of total government revenue in 1987-92; the states' share has averaged 13 percent and local governments' 3.5 percent. Figure 5.9 shows the



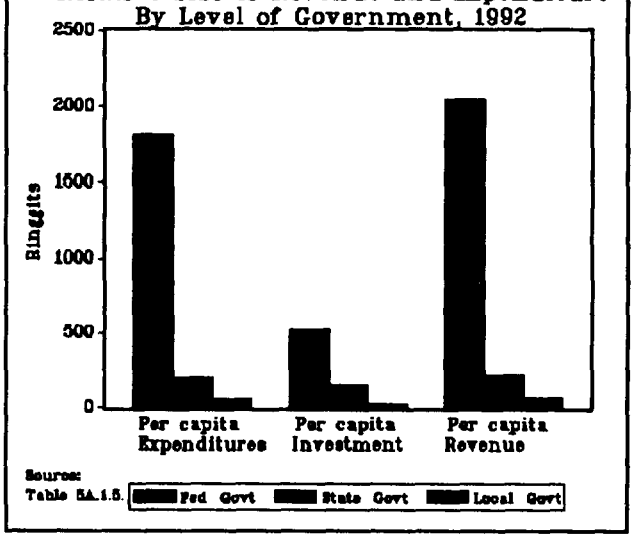
creeping federal centralization of revenues; federal government's share has tended to increase in recent years while that of the states' is declining.

5.44 The financial health of the LA's is directly related to the financial strength of the states in which they are located. The constitution mandates that the federal government share its much larger revenue base with the states and Local Authorities. This enables the federal government to assist the poorer states by giving appropriate weight to equity in the allocation of development funds and in the revenue sharing formulae. The states then pass on revenues to their respective LA's in the form of state grants and loans (see Appendix V. for a discussion of the revenue sharing system in Malaysia).

5.45 Fiscal dependency of the states and local governments on transfers from higher levels of government can be seen from the following facts. For the states, federal grants have amounted on average to 19.2 percent of expenditure and 22.1 percent of revenue between 1987-92. For Local governments, on the other hand, state and federal transfers were, on average, 17.3 percent and 16.7 percent of total expenditure and revenue, respectively (Figure 5A.1a and 5A.1b in the appendix). The relationship of fiscal dependency is further highlighted by the fact that without state and federal government transfers, local governments would have run up an overall deficit RM 400 million in 1992, which was 9.2 percent of the consolidated fiscal deficit.

5.46 Despite the elaborate transfer mechanism, states and especially LA's are small players in the Malaysian economy compared to the federal government. This is clearly seen in Figure 5.10, which shows per capita revenues and expenditures for the three levels of government. Federal government mobilizes 28 times larger per capita revenues than local authorities and incurs 33 times larger expenditures. Similarly, per capita federal investment is 23 times larger than that of local authorities.

Figure 5.10
Relative Size of Revenue and Expenditure By Level of Government, 1992



The Constitutional Dilemmas

5.47 The provision of sewerage is expensive and involves the payment of a service charge to the provider. This raises two important issues: (i) the fees must be assessed correctly and (ii) the billing procedure must be designed efficiently; the latter require taking advantage of the economies of scale from combining the sewerage and water bill. If the billing authority is different from the provider of the facility, difficulties arise in collection that ultimately threaten the financial viability of the service provider. This is best illustrated by the problems Kuala Lumpur Bandar Raya (City hall) faces in billing for sewerage.

5.48 KL residents are fortunate in that 40 percent are connected to the central sewerage system while another 35 percent are serviced by local systems (Imhoff tanks etc for primary waste treatment). A sewerage charge is levied for the service provided based on metered consumption. There is a residential charge at the rate of 18 M Cents per cubic meter and a commercial charge at the rate of 44 M Cents. The number of sewerage accounts in December 1991 were estimated to be 60,000 and revenues were projected at RM 12 million. Actual collections, however, were about RM 8 million or about two third of what was projected. Bandar Raya officials blame the shortfall on the weak billing system.

5.49 Kl Bandar Raya does not bill consumers directly but is dependent on the water authority. The water authority reads the meter for water consumption and then bills the consumers. It then sends a separate bill for sewerage consumption. There is substantial default on water bills especially by government institutions and hotels (200 accounts are RM6 million in arrears). The City water authority is under political pressure not to cut water and to make up for its revenue shortfall, it shows the defaults on the sewerage account.

5.50 At the state level, the billing problem is even more acute and goes to the heart of the constitutional dilemma. The LA's are even more dependent on the state authorities for collecting the sewerage rates and are politically in a much weaker position than the more affluent KL Bandar Raya. The constitution, however, clearly specifies water to be a state matter while sewerage is provided by local authorities. In conflicts between the states and the LAs on billing and collection of sewerage charges, the LAs are in a weak bargaining position because they are creatures of the states in which they are located. This difficult constitutional problem would have to be resolved, if LA's are to continue to provide an efficient and financially viable sewerage service.

Administrative Weaknesses

5.51 The administrative weakness of LA's is seen in their inability to regularly update property assessments and then collect dues on rates, which is the most important source of their income. Even the most developed LA's, such the KL Bandar Raya and Selangor municipal authority, face this difficulty. Based on 1991 rates, revenue for Kl Bandar Raya were estimated at RM25 million. However, only RM 22 million were actually collected. The situation is far worse in the less developed LA's. Even though the Johor Bahru Bandar Raya has revised its property values, rates were actually lowered by the council, which led to poor revenue yields. Thus problems arise both because of the technical deficiencies that cause delays in property valuation as well as due to institutional weaknesses that renders LA's susceptible to political interference by interest groups that want to keep a lid on rates.

5.52 Technical difficulties faced by LA's are especially acute in new project design and implementation. A technical assistance unit in the Ministry of Housing and Local government has been assisting the LA's since 1980 in project design as well as in the preparation of by-laws and staff training for public health engineering. The unit, however, has limited staff and can meet only a fraction of the demands placed on it.

5.53 Some of the technical demands on LA's are: making bye-laws for uniform building, private streets, drainage, sanitation and sanitary plumbing, setting technical norms for town and country planning and giving permissions to build and alter, monitoring and enforcement of zoning laws etc. To perform all these functions satisfactorily, skilled manpower requirements (such as engineers, draftsmen, technicians etc) would be substantial and far in excess of the resources currently available.

5.54 Chronic shortages of personnel in the technical categories further weakens the Local Authorities. The overall shortage of skilled workers in Malaysia combined with the federally mandated salary increases has made a big dent in the LA budgets. Between 1988 and 1992, personnel related costs accounted for 51 percent of the total current expenditure of LA's (Table 5.13). Salaries have increased also due to competition from the private sector for well-trained staff, where salaries have outstripped those in the public sector. As the pace of economic activity picks up, skill shortages and the associated budgetary problems in the public sector are likely to become even more acute.

Table 5.13: Personnel Costs in Local Authority Budget, 1988-1992
(RM millions)

	1988	*1990*	*1992*
Current Expenditure	837.82	1005.85	673.18
Personnel Costs	424.18	534.84	522.7
Percentage	50.6	53.2	51.2

Source: Treasury

5.55 In sum, the financial, constitutional and administrative weaknesses faced by the local authorities severely limit their capability to perform the myriad services expected of them. This is especially true for continued adequate provision of sewerage facilities, for which demand is increasingly rapidly due to income growth and the rapid pace of urban housing development. Already there are growing signs of stress on LA's as they struggle to maintain existing facilities (LA septic tanks) and carry out proper de-sledging of private septic tanks. In fact, when asked what would be their one wish to the fairy godmother, the answer given by LA management in both KL and Johor Bahru Bandar Raya to the Bank mission was that the responsibility of sewerage be taken away from them.

5.56 Given the present fiscal and administrative weaknesses, it would take a major policy thrust to reform the LA's to undertake the increased investments and supervise the expanded sewerage networks required for a healthy urban environment. To mobilize the additional resources required, the federal government will have to increase its transfers substantially and/or local rates will have to be increased manifolds. There is little indication that the federal

government is about to do so or that local property owners would support the rates initiative. An alternative approach, and one towards which the government is increasingly inclined, is to privatize sewerage in some selected localities and thus reduce the burden of this responsibility on the LA's. This would free up LA resources (financial as well as human) in these localities for increased monitoring of industrial and hazardous waste abatement as well as providing an input into the mechanism for regulating the private provision of sewerage. However, privatization of sewerage is a complex issue and needs to be approached with caution.

E. The Privatization Route

5.57 Continued public provision of municipal services requires striking a difficult balance between three competing demands; (i) the need for greater investments in these services; (ii) the need to keep tax rates low and internationally competitive and (iii) the need to avoid fiscal deficits to maintain macroeconomic stability. Moreover, there are now widely expressed doubts about the ability of the weak local authorities to shoulder the additional responsibility of increasing services and raising the resources locally to pay for them. The government, therefore, increasingly looks to the private sector to take over the delivery of these services. This is consistent with the overall privatization policy announced in 1983, that signalled the intent to reduce government presence in the economy and allow competitive market forces to govern economic activity.

The Current Proposals

5.58 The privatization unit in EPU, responsible for the privatization plans, is currently evaluating the proposals of private parties and was reluctant to share the detailed written documents with the Bank mission. The description of the proposed plan for the privatization of sewerage collection, treatment and disposal, presented below, is thus based on detailed conversations with the officers in charge of the privatization unit.

5.59 Coverage: Under the privatization proposal, initially 90 percent of the sewerage needs of 43 local authorities would be met. However, the service by the private company will cover all the operational areas of all Local Authorities in Malaysia. Under the proposal, the private parties would take over current public sewerage networks as well as build new ones. The Private Sewerage System (i.e. septic tanks) will be maintained by the owner but desludging will be done by the private company. In the rural areas, the Ministry of Health will assist in the construction of sanitation facilities. The proposal would require private investment of nearly RM 6 billion over 18 years to provide the network needed for adequate coverage. The total lease period would last 28 years.

5.60 The proposed 43 local bodies initially delineated for sewerage privatization are the richest in the country and therefore the most lucrative for the private investors. Even within these, however, there is considerable variance in profitability. Table 5.14 below shows this in terms of the changes

in the internal rate of return on investment and the important influence of the three richest local authorities, Kuala Lumpur, Petaling Jaya and Johor Bahru.

Table 5.14: Estimates of Profitability in Private Sewerage Investment

Local Authorities	*Internal Rate of Return*
Initially proposed 43 localities	14%
Excluding the richest 3 (Kuala Lumpur, Petaling Jaya and Johor Bahru)	-5.4%
Excluding Kuala Lumpur	7%
Excluding Petaling Jaya & Johor Bahru	3.4%
Kuala Lumpur alone	10-15%

Source: EPU estimates of projected returns.

5.61 The rates of return reported in Table 5.14 are based on an average service charge of RM 15 per month using the affordability criterion. This is similar to the service charge currently levied by the Kuala Lumpur Local Authority. It is expected that the quality of service nation-wide would be a considerable improvement over the current situation.

5.62 Past Experience With Privatization: On several criteria, past privatization in Malaysia has been successful and prepares the country well for the current new thrust. Appendix V.2 reviews the performance of three firms (Malaysian Airlines System, Kelang Container Terminal and Sports Toto) privatized recently and concludes that their performance improved after privatization (Table 5A.1) and that there was a net welfare gain to the society; the welfare gain is quite impressive by international comparisons (Table 5A.2.2). While this experience will be a good guide in the future, care needs to be exercised for the following reasons: (i) all three cases examined involved privatization of lucrative public concerns; (ii) monopolistic structures of all three entities were retained even after privatization and (iii) government involvement continues in a substantial decision-making role in all three cases.

5.63 The current phase of privatization would pose new challenges. Firstly, as discussed above, sewerage collection and disposal command a modest rate of return, even after assuming that the difficulties of billing and collection are resolved. Secondly, the sewerage privatization proposals being considered would add to the number of large private monopolies in the economy, and would require considerable regulatory expertise in the government to negotiate prices and to ensure adequate coverage and standards. Regulating private collection and treatment of sewage is particularly difficult because it is in the nature of a public good and is quite different from the products produced by the three previously privatized concerns.

5.64 The Monopolistic Structure: There is some evidence on scale benefits of large sewerage companies because (i) less staff is needed per 1000 connection and (ii) other operational costs per connection are also lower which frees up resources to (iii) offer better wages and hence attract better qualified staff (see Table 5.15). Moreover, there may be administrative advantages to the Government in dealing with only one contractor. But these benefits accrue even in a setting where there are several regional companies in a country. In any case, it is not at all clear that they out-weigh the costs of strengthening monopolistic structures in the economy. Furthermore, setting up a monopoly also robs the government of the valuable information base essential for performing its regulatory function.

Table 5.15: Company Size and Cost of Operations[1]

	Company	*Size*	*Range*	*(1,000 water connections*	
	10	50	100	500	1,000
Staff/1000 Connections[2]	10.8	9.2	8.6	7.3	6.8
Staff/1000 Connections	1.3	1.1	1.0	0.9	0.8
Average Salary/Staff	0.94	1.03	1.0	1.31	1.61
Operating Cost/Connection	1.29	1.08	1.0	0.84	0.78

Source: World Bank Discussion Paper INU 61, Management and Operational Practices of Municipal and Regional Water and Sewerage Companies in Latin America and the Caribbean.

[1] Survey of 37 regional companies in Mexico; Company with 100,000 connections chosen as basis for the index;

[2] Absolute numbers of staff.

5.65 To ensure that the public interest is protected in the private provision of sewerage, the government needs to set up an efficient regulatory body. One option is to decentralize the regulatory function requiring private parties to sign agreements separately with each local authority. The alternative (currently favored by the government) is to have a federal regulatory body with one-on-one discussion between the private monopoly and the federal government regarding coverage and quality of service and the tariff to be levied. The ideal solution would be to combine the monitoring advantage of the former with the negotiating advantage of the latter. This requires giving adequate representation to local authority personnel on the government negotiating board.

Monitoring should continue to be decentralized and the board should frequently review complaints by the LA's regarding the quality of service and coverage.

5.66 The tariff structure is still being worked out. According to information received from the government the tariff structure will be based on the assessed value of the property and on consumption (derived from consumption of water). This will ensure that the principle of equity and fairness is adhered to. Based on these considerations, it is estimated that the average monthly tariff for a household will be around RM 5. The tariff rate would be reviewed every 5 years to safeguard consumer interest and ensure project's financial viability. An important aspect in setting the tariff structure is to reflect consumer demand as measured in the willingness-to-pay. The regulatory authority would need to carry out willingness-to-pay surveys frequently to ascertain consumer satisfaction with services provided as well as their willingness to bear price increments. The willingness-to-pay approach is discussed in Section F.

5.67 Although Malaysia's experience has led the government to seek out the privatization route, other countries show that the Public provision of sewerage and clean drinking water need not be a burden on the public exchequer. A number of lessons can be learnt in this context from the experience of successfully run public utilities elsewhere (see Box 5.1 on the U.S. experience). Firstly, financial autonomy and accountability of such public utilities is essential, which may be achieved by authorizing the utility to issue public debt (bonds) and subjecting bond issue to independent credit rating. Secondly, the budget process should be transparent and open to public hearings. Thirdly, development charges must be an important component of financing for capital expenditures; new debt servicing should be levied on homeowners in the newly developed areas and not passed on as additions to the general service charge to all consumers. Fourthly, the utility should be subject to strict environmental regulations, particularly regarding bacterial and hazardous material in samples taken from clean and waste water. Fifthly, there are economies of scale (in billing, materials and personnel) in the joint provision of drinking water and sewerage; institutions should be restructured to enjoy these economies.

5.68 Malaysia would benefit from setting up a pilot public utility in areas earmarked for privatization. Such a utility would provide a data base for regulating the private monopoly. This model public utility would be organized as an autonomous body incorporating the lessons of successful international experience summarized above. Given the constitutional problems in local government finance and the separate responsibilities of the state and local governments in the provision of water and sewerage, the model utility should be located in the federal territory. Residents of the locality should be represented on the board as watchdogs over the utility's budgetary proposals and as monitors of the quality of service provided. The lessons of such an experiment would be invaluable in regulating the private monopoly and for replicating publicly provided service in areas not assigned to the private consortium.

Box 5.1: The Experience of Washington Suburban Sanitary Commission (WSSC).

The experience of Washington Suburban Sanitary Commission (WSSC) in the United States is instructive of how a public utility can provide clean drinking water and safe treatment and disposal of sewage efficiently without burdening the public exchequer. WSSC was set up in 1918 by an act of the General assembly of the State of Maryland. It is chartered to plan, design, construct, operate and maintain water and sanitary sewer services for the residents and the business community of Montgomery and Prince George's counties. In 1993, the WSCC is expected to service 365,200 customers (about 1.4 million users) supplying 168 million gallons per day of drinking water and providing for 175 million gallons per day of sewage flows. The total number of WSSC employees is 2100 and the total budget for fiscal 1993 was US$ 651.6 million, US$259.2 million of which was for capital expenditure and US$396.95 for operating expenditure. It is the 7th largest utility in the United Sates and is considered one of the nation's leaders in the industry.

The Commission is financed through water consumption and sewer use charges, water supply bonds, sewage disposal bonds, federal and state grants (now declining), a system of development charges, general construction bonds, front footage benefit charge (assessed as part of the property tax) and other fees and charges. The capital program is financed primarily by bonds. New projects are funded in two ways: (i) construction of major facilities (treatment plants, pumping stations, storage facilities and large water and sewer lines) utilizes funds primarily from water and sewerage bonds issued by the Commission; and (ii) construction of smaller facilities (smaller diameter water and sewer pipes) is funded by general construction bonds and payments by developers. The WSSC bonds are backed by property assessments and thus enjoy a AA+ rating in the capital market.

WSSC budgetary process is transparent and subject to considerable public scrutiny. The Montgomery and Prince George's county councils that administer the utility on behalf of the State of Maryland, hold open hearings on the budget and give their approval for bond authorization (for capital expenditures on construction projects) and rate increases (for operating expenditure). The debt-service on bonds is supported by water consumption and sewer usage charge. These charges constitute 74 percent of the utility's income, while front footage benefit charge accounts for another 13 percent. On the expenditure side, the largest item is debt service at 51 percent, followed by operation and maintenance at 25.6 percent and regional sewage disposal at 10 percent.

The capital market has recently signalled some concern over the high bond debt of WSSC (which now stands at US$ 1.7 billion). In response to this, and given declining state and federal grants, the commission is seeking alternative ways of financing expenditures. One approach being considered is to increase development charges on new schemes (both for major as well as local facilities) and to pass these on directly to the new homeowners and thus reduce reliance on bond issue. In the absence of such alternatives, service charges to existing consumers would have to be increased to finance debt service on bond issue. As it is, water and sewerage service rates have increased nearly 10 percent in fiscal 92 and 93 despite the recession. Further increases might not be politically feasible.

By many criteria, WSSC is an efficiently run public utility. Productivity improvement continues as measured in indicators such as workyears per thousand customers, miles of pipelines maintained per workyear, water production per workyear and wastewater treatment per workyear. Customer service is also improving in terms of criteria such as restoration of service within 24 hours and a much reduced response lag to public calls and complaints. Moreover, the utility has never been cited for permit violations for sewage treatment (both drinking and treated waste water are regularly monitored for presence of bacteria and hazardous matter); such compliance to Maryland's stringent environment regulations is no mean achievement.

The experience of WSSC shows that financial autonomy combined with public scrutiny can result in a successfully run public utility to provide clean drinking water and safe treatment of sewage. The perception that a good rating by the bond market is crucial for survival has encouraged financial responsibility. Furthermore, regulatory authority exercised by the county councils discourages the temptation to pass on inefficiencies to the consumer in the form of a rate increase. Public scrutiny has also ensured that environmental regulations are met. Perhaps the biggest achievement of WSSC is that it was a major player in restoring the Potomac river (which passes through the Washington metropolitan area) from an open sewer a few decades ago to a healthy river today supporting aquatic life and recreation.

F. Improving Urban Services: A Demand Driven Approach

5.69 In the past, government provision of urban services has been guided by the public health approach and, later, by the affordability criterion. The former is essentially supply oriented and focuses on the technical/health aspects of services. The latter is only partially demand driven since it calculates user fees as a fixed proportion of income. Both these approaches have been found to be unsatisfactory because they have not sustained public interest in the service, which has led to its deterioration and ultimate abandonment.

5.70 The new demand-driven approach, known as the willingness-to-pay method is increasingly used by the public sector to obtain relevant information (technically called the contingent valuation method), and is included as a part of more general household surveys. It is analogous to market surveys used by the private sector for various products but is designed to obtain information about non-marketed goods or services.[1/] (The different approaches to providing urban services are briefly discussed in Appendix V.3)

5.71 The advantage of this method is that it provides information on the type of service needed and the price to be charged. It paves the way for communities themselves to provide and operate services -- a move that has met with striking success in extending services to areas where there was little possibility earlier. Thus, it is essential to devise methods to find out what services people want and are willing to pay for.

5.72 Under the sewerage privatization proposal in Malaysia, the private sector would invest RM6 billion over the next 18 years to upgrade and expand the service. There will be some cross-subsidization from profitable projects to the less profitable ones. One mechanism for such cross-subsidization is that commercial and industrial structure would pay a service charge nearly 3 times that paid by residential structures.

5.73 The demand-driven approach could be useful to assess what level of service consumers want and are willing to pay for, and how much they would participate in providing. Thus, in order to regulate the private contractor so as to promote good quality serve and adequate coverage and set prices correctly, the Government must carry out such surveys -- in the 43 and remaining 110 localities; in this way, it would have the necessary information during negotiations with the contractors and afterwards, to monitor compliance.

5.74 For example, it is still unknown whether households presently served by communal septic tanks would be willing to pay more to be connected to the centralized sewer system since they would not derive any extra private benefits and whether those who have invested in individual tanks would want to connect to the central sewer, since their private benefit would at best be minimal. Of course, such choices may not be offered and connecting to the main may be

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[1/] For details of the method, see Mitchell and Carson, 1989.

mandatory. However, if this occurs, households may be reluctant to pay for the unwanted service.

5.75 No secondary information is available in Malaysia on consumer willingness to pay for urban services. Although such information had been used in earlier planning studies, follow-up investigations revealed that all these related to the level of service and used the affordability criterion mentioned earlier. The Kuala Lumpur Sewerage Master plan is one example of using the latter to indicate consumer demand.[2] Another example is the Coastal Village Environmental Improvement Project that recommends a charge of 5% of income for the services provided.[3]

5.76 The mission was not able to examine the report for the private sanitation proposal (or for the hazardous waste treatment plant) and it is impossible to say whether willingness-to-pay information was considered in these proposals.

Illustrative Survey

5.77 Given that no secondary information was found on demand-side issues pertaining to urban services, and the authorities asked the mission to conduct a survey. The object was to illustrate the possibilities opened up by such a survey and not to interpret the particular numbers obtained because of the limitations of time and money and lack of preparation. Further, the survey was not meant to be a formal application of the contingent valuation method since that was not possible with the resources available.

5.78 The mission administered a very brief questionnaire to 102 respondents in Kuala Lumpur. Eight areas of the city were identified on the basis of household sanitation systems (using information from City Hall) and about a dozen households were interviewed in each area. The sample was thus random but not representative of the city's population. Relevant details of the sample areas are presented in Table 5.16. The questionnaire is attached as Appendix V.4.

5.79 The sample questionnaire elicited information on the level of satisfaction with existing household sanitation and solid waste services; on preferences regarding the choice of provider of improved services; on perceptions of the major cause of pollution in Kuala Lumpur and the importance of improving environmental conditions in the city; on the prioritization of various possible environmental improvements; and on the willingness to contribute to hypothetical fund to improve the environment in Kuala Lumpur if such a fund were set up by the government.

5.80 Results from such a survey can be used to find out the level of satisfaction with existing services and to identify neighborhoods with special

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[2] ADB/GOM, 1989; City Hall, 1988.

[3] ADB/GOM, 1989, p. xxxviii.

Table 5.16: Sample Areas

AREA	# RESPOND	SANITATION SYSTEM			
		CENTRAL SEWER CONNECTION	COMMUNAL SEPTIC TANK	INDIV. SEPTIC TANK	BUCKET LATRINE
Bangsar	14	14	0	0	0
Kepong	10	0	10	0	0
Jalan Kelang Lama	14	1	0	7	6
Datuk Keramat	14	14	0	0	0
Kampong Baru	14	14	0	0	0
Setapak	12	0	12	0	0
Taman Ibukuta	12	0	0	12	0
Jinjang	12	0	0	12	0
TOTAL	102	43	22	31	6

problems. For example, the illustrative survey confirms that the quality of municipal services in Kuala Lumpur is much higher than in most other cities in developing countries. About 88 percent of the respondents reported no problems with their existing sanitation arrangements; about 67 percent were satisfied with the collection of solid waste from their residences and 60 percent were satisfied with the disposal of solid waste from their neighborhoods. Dissatisfaction with sanitation was greatest in Jinjang where half the respondents reported problems with their existing arrangements (individual septic tanks). Dissatisfaction with solid waste collection was concentrated in two areas: Jalan Kelang Lama, where all the respondents were unhappy and Jinjang, where 58 percent had complaints. Dissatisfaction with the disposal of solid waste from neighborhoods was more widespread. In Jalan Kelang Lama, Datuk Keramat, Kampong Baru and Jinjang, the percentages 43, 50, 36 and 67, respectively. The details are shown in Table 5.17. A detailed survey can also elicit the reasons for the dissatisfaction, which can lead to appropriate remedial action.

5.81 Respondents were also asked if sanitation and solid waste services could be provided more efficiently by the municipal corporation or the private sector. Two-thirds (64%) indicated a preference for the municipal corporation. Only in one area of the city (Taman Ibukuta) did the majority (67%) prefer the private sector. The most common reason given by the latter was that they believed the service would be more frequent.

5.82 Such information could be very useful in advance of the proposed privatization of sanitation and solid waste services. The Government's preference for privatization is based on wanting to reduce the size of the civil service and the budget deficit, reasons that are of little relevance to most

citizens. However, authorities could consider educating and convincing citizens that privatization would be in their interest, which could, in turn, maximize their acceptance of the proposed program. Investigating the reasons for respondents' preferences could highlight what they desire (such as, more frequent service) and what they are apprehensive about (such as, higher charges by the private provider). Addressing these desires and apprehensions would provide a starting point for the public education effort.

Table 5.17: Satisfaction with Existing Services
(Number of Respondents)

AREA	*SANITATION*			*SOLID WASTE COLLECTION*		*SOLID WASTE DISPOSAL*	
	No Problem	*Some*	*Many*	*Satisf.*	*Disatis.*	*Satis.*	*Disatis.*
Bangsar	14	0	0	13	1	-	-
Kepong	8	2	2	6	4	7	3
Jalan Kelang Lama	11	3	0	0	14	8	6
Datuk Keramat	14	0	0	12	2	13	1
Kampong Baru	13	1	0	13	1	9	5
Setapak	12	0	0	9	3	9	3
Taman Ibukuta	12	0	0	10	2	9	3
Jinjang	6	4	2	5	7	4	8

5.83 A public education effort to communicate information to people is clearly warranted, especially since it often affects willingness to pay for improved facilities. For example, respondents were asked what they thought was the major cause of environmental pollution in Kuala Lumpur. The overwhelming majority (78%) mentioned motor vehicles while 15% identified industry. This clearly reveals that respondents are unaware of the importance of household waste, especially excreta, as a source of pollution.

5.84 Respondents were also asked to prioritize possible improvements in air quality, water quality, sewer service and solid waste management. Improvement in air quality was ranked first most often (36% of first place rankings); water quality obtained 31% of first place rankings; waste services obtained 18% and sewer service obtained 14% (the number of first place rankings exceeded the number of respondents because of ties). Improvement in air quality was most important in Jalan Kelang Lama, Kampong baru, Setapak and Taman Ibukuta while improvement in solid waste service was more important in Bangsar, Kepong and Jinjang. The rankings suggest that respondents attach more weight to private benefits since the link with poor air quality and water is much more direct. Public or more long-term benefits such as those resulting from improved sewer and solid waste service are given less weight. To generate and sustain support for environmental improvements that yield indirect and long-term gains, the public would need to be made aware of how pollution impacts their lives. Once again, this points to an area for public education.

5.85 Respondents were asked whether, at the present stage of the country's development, it was important to allocate resources to improve environmental conditions in Kuala Lumpur. Fifty one percent felt it was very important, 40% said it was fairly important, and 9% said it was not very important. In general, the responses suggest that people either do not perceive there is a trade-off between development and environmental improvements or are not willing to sacrifice environmental improvements. A more detailed survey could obviously go deeper into the subject to elicit opinions on the relative preferences for economic development and environmental protection as this is a major concern of officials.

5.86 Finally, respondents were asked a highly simplified and direct question, such as how much they would be willing to contribute to a hypothetical Government fund to improve the quality of air, water, sewer and solid waste services in Kuala Lumpur -- in addition to their current service charges. Approximately two-thirds (62%) indicated a willingness to contribute a positive amount with the average about RM 10 a month. The remaining 38% were not willing to contribute anything; thus, the mean contribution over the entire sample was approximately RM 6 per month. To determine why some were unwilling to contribute anything to improving the environment, a follow-up survey could be conducted.

5.87 A separate question was asked regarding the components of urban environment to determine priorities for expenditures to improve the environment. Bivariate correlations then establish the link between the willingness to pay and expenditure targeting. The results are reported in Table 5.18 which shows that willingness to pay is generally higher for those respondents dissatisfied with existing sanitation and solid waste services. Greater willingness is also indicated by respondents who consider improving the environment to be very important (RM 6.4 against RM 6.0 for those who considered it fairly important and RM 3.9 for those who considered it not very important).

Table 5.18: Correlation of Contribution with Independent Variables

VARIABLE	*MEAN CONTRIBUTION (RM per Month)*
TYPE OF SANITATION	
Central Sewer Connection	4.91
Communal Septic Tank	9.73
Individual Septic Tank	5.68
Bucket Latrine	0
SATISFACTION WITH SANITATION SYSTEM	
No Problems	5.91
Some Problems	6.90
Many Problems	0
SATISFACTION WITH SOLID WASTE COLLECTION	
Satisfied	5.81
Dissatisfied	6.83
IMPORTANCE OF ENVIRONMENTAL IMPROVEMENT	
Very Important	6.41
Fairly Important	5.98
Not Very Important	3.09
PREFERRED PROVIDER OF SERVICES	
City Hall	4.03
Private Provider	9.16

5.88 When capacity expansions are being planned, it is useful to identify average rate paid in various urban neighborhoods, since these vary greatly, for example, the mean value is only RM 0.36 per month in Jalan Kelang Lama while it is RM 16.50 in Kepong (Table 5.19). Thus, if such variations had been revealed in a scientific sanitation survey, Kepong would have been the logical place to extend of the sewer network if there were no reasons to discriminate on other grounds, such as, technical or topographical.

Table 5.19: Mean Contribution by Area
(RM per Month)

AREA	*MEAN CONTRIBUTION*
Bangsar	2.50
Kepong	16.50
Jalan Kelang Lama	0.36
Datuk Keramat	6.86
Kampong baru	5.71
Setapak	4.08
Taman Ibukuta	7.58
Jinjang	6.67

5.89 Willingness to pay is correlated with other variables as well. For example, the mean monthly charges by type of existing sanitation facility were as follows: RM 9.7 for those connected to communal septic tanks; RM 5.7 for those with individual septic tanks; RM 4.9 for those connected to the central sewer system; and nothing for those with bucket latrines. Similarly, willingness to pay varies by who provides the services: The mean value for those who preferred the private sector was RM 9.2, while it was RM 4.0 for those who preferred the municipal corporation. Obviously, income and other socio-economic characteristics influence responses and a proper survey would obtain information to control for such effects as well as to plan appropriate cross-subsidization schemes, if necessary.

5.90 Even in this very small survey, the mean value of the contribution displays a plausible correlation with other variables. A full willingness-to-pay survey would obtain additional information on other relevant variables (such as household income, age and education of respondents, family size, number of earners and expenditures on existing services) in order to estimate a multivariate model correlating willingness against a set of independent variables. Such a model not only helps validate the credibility of the information obtained but can also predict willingness to pay for services in other neighborhoods or their willingness is likely to change as independent variables alter over time. Examples of such multivariate analysis can be found in the willingness-to-pay studies referred to earlier.

G. A Summary and Recommendations

5.91 Urban services in Malaysia are under pressure now from rapid income growth and urbanization. Although the coverage of clean drinking water in urban areas is high at 96 percent, inadequacies in the sewerage and drainage systems

are beginning to threaten urban water quality. The accumulation of solid waste is also very rapid and is outstripping the ability to provide safe landfills. To cope with these needs and to maintain a clean and healthy environment annual investments of around US$ 1.5 billion are needed. Actual investments in the Sixth Plan, however, are only one fourth of this. The resulting shortfall could have serious consequences for urban Malaysia. In view of this the government is seeking public as well as private solutions. Meanwhile, several steps could be taken in the short term to anticipate and avoid major deterioration of the urban environment.

Short Term Measures

5.92 Monitoring the quality of drinking water needs to be tightened. The Ministry of Health is responsible for monitoring drinking water quality (including the bacteriological content) and is in charge of the country's sanitation program. To strengthen its capabilities, the MOH would need to have the power to levy fines for non-compliance with Government standards. To complement the MOH efforts, it is recommended the DOE regularly monitor and report the bacteriological count in the rivers, and thus fill a gap in its otherwise well-conceived river monitoring system.

5.93 Municipalities are responsible for monitoring the performance of the sewerage and sanitation treatment facilities. However, their role needs to be expanded to include monitoring and reporting on the performance of individual septic tanks and water quality in drains and river sections within the municipality's jurisdiction. It is also recommended that municipalities regularly monitor and report on the condition of solid waste dumps by installing monitoring wells at dumps where leachates might infiltrate the groundwater or might leak into drains or streams.

5.94 The need for tighter monitoring is recognized in Malaysia and although various agencies have identified what resources they need to follow Government instructions, sufficient finances are often unavailable. Given the considerable need to disseminate environmental information with regard to urban services, (such as monitoring leaks and informing the public about water quality) it is recommended that agencies work closely with urban environmental NGO, that can raise environmental consciousness on low budgets.

5.95 There is also room to improve efficiency of the existing systems. Some of the recommended measures are: (a) increasing employee productivity in the delivery of water; (b) putting in place a program for systematic de-sludging of tanks in housing developments and (c) implementing the ABC program for solid waste management. These steps do not require significant investment and are necessary interim steps while the longer term strategies for improving the urban environment are being designed.

Medium Term Issues

5.96 Local Authorities loom large in urban environment as providers of municipal services and monitors of abuse. However, the LA's in Malaysia are financially distressed, their technical staff are over-stretched and they face difficult constitutional problems in streamlining budgetary problems. These difficulties need to be addressed. One promising approach would to switch the role of LA's from providers of services to regulators and monitors. This would alleviate the financial and technical burden on LA's; but it would require investment in additional training to acquire expertise in regulating and monitoring.

5.97 While strengthening the responsibilities of municipalities for environmental monitoring, conflict of interest should be avoided. A distinction should be made between monitoring of private and public use of facilities for which municipalities are responsible (e.g., landfills, sewers, drains) and monitoring of impacts caused by inadequate management of municipal treatment plants) where higher levels of government should monitor municipal performance. Where the private sector is an agent of the municipality to operate such facilities, it should still be accountable to a higher level of environmental authority.

5.98 Privatization of sewerage is a courageous step. There is little international precedence of this and Malaysia's own past privatization experience, although successful, is not a good guide in handing over a public service to a private monopoly. One thing clear is that while private delivery of sewerage will alleviate the financial burden on the government, it will require continued government presence to protect the public interest. This requires that the process be kept transparent to catch potential problems associated with the monopoly at an early stage. It is also desirable that flexibility be retained regarding the period of exclusivity and pricing formulae so that these can be modified as regulators learn more about the privatization process.

5.99 It is recommended that even in the relatively high income areas earmarked for privatization, the government retain at least one pilot locality where sewerage continues to be provided publicly; this would help build up the information base and would ensure that the monopoly provider charges a fair price and provides good coverage and quality.

5.100 Both as a provider of municipal services (in areas not earmarked for privatization) and as a regulator of private monopoly, the government would need to carry out frequent surveys to inform itself of consumer demand for services. Such surveys of the willingness-to-pay have been found to be a useful tool for incorporating demand side considerations in the technical design of the service, its coverage and the fees structure. The international experience is that projects that reflect such demand considerations are "owned" by communities they serve. This helps in maintaining the quality of service and strengthens chances of project survival.

Appendix V.1

Fiscal Relations Between Federal, State and Local Governments

The Constitutional and Administrative Arrangements

1. Under Malaysia's constitution, the nation is a Federation with state governments retaining a degree of control of their internal affairs as prescribed under the Federal list, the State list and the Concurrent list[4]. The constitution, however, has a strong bias towards centralization. The states' legislative powers are circumscribed and the federal parliament has power to legislate on state matters. In implementing national development plans and instituting policies under the National land Council and the National Council for Local Government, the federal government takes the leading role.

2. In matters falling under the Concurrent list, conflicts between state and federal governments are resolved through an elaborate consultative process which consists of political organs such as the Chief Ministers' Conference and the annual Conference of rulers (Sultans) and in administrative forums such as the National Development Council, the Federal-State Liaison Committee, the National Development Planning Committee, the National Finance Council, the National Council, the National forestry Council and the National Council for Local Government (NCLG) and several inter-agency technical working groups. For implementing development plans, the Director-General of the Economic Planning Unit (at the federal level) closely coordinates the activities of Directors of the State Economic Planning Units (SEPUs), who are often federal employees on loan to the state governments. SEPU's implement both state as well as jointly-funded programs.

3. Established under an article of the federal constitution in 1958, the NCLG enables state governments to enact regulations governing the local authorities (LA's). The federal Ministry of Housing and Local Government provides the secretariat, the Minister is the chairman presiding over the council consisting of one representative from each state and ten representatives of the Federal Government.

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[4] The federal list consists of external affairs, international trade, defence, internal security, civil and criminal law and administration of justice, citizenship, finance, currency and banking, commerce and industry, shipping, education, medicine and health, social security and labor and newspapers and publications. The state list covers land, agriculture, forestry, local government, matters pertaining to muslim law, riverain fishing etc. The concurrent list concerns social welfare, public health, drainage, sanitation and prevention of diseases, scholarships, protection of wildlife and town and country planning.

4. For administrative control and harmony, the Chief Secretary to the Federal Government heads many of the forums listed above. Sins he is also the chairman of the promotion and disciplinary boards of the Federal civil service and recommends leading public appointments, he commands considerable allegiance and respect from civil servants at the state and federal levels. This is key to the effective coordination achieved at the various levels of government.

5. The LA's fall into three categories ie City Councils, Municipal Councils and District Councils reflecting principally their relative population and area size. The planning and implementing principle, under which LA's implement development plans, is the user-pays principle whereby each urban dweller pays a fees for the use of facilities being provided. The LA's are creatures of the state government and are designated as autonomous bodies under the Local Government Act, 1976. They are headed by the State chief Minister or his nominee who presides over councilors nominated by the state government.

6. The annual budgetary exercise through which plans are implemented at the Federal level, is undertaken by the Treasury in consultation with the EPU, which consolidates requirements at the state level. The Malaysian Business Council, headed by the prime Minister, also contributes to this process. At the State level, economic plans are deliberated by the State Planning committee, chaired by the Chief Minister with the State Secretary, Director of the State EPU, the Sate Town and Country Planning Director, and Heads of relevant Federal and State Departments as members. At the District level, the District Development Committee comprising of State Assemblyman of the District, the Village headmen and relevant district departments and agencies as the relevant Local Authorities, and chaired by the District Officer, plans and proposes projects for approval by the State government.

7. It is broadly agreed in Malaysia that most state and local governments are financially weak and have limited skills and management capabilities, which results on excessive reliance on the Federal government especially concerning implementation of economic development schemes. The Federal government takes the lead, moreover, to redress regional imbalances in income opportunities and public amenities. The Federal Government thus provides technical and financial assistance to state and LA development plans and in implementing projects, apportions development allocations across states and LA's and strengthens state and LA planning capabilities.

Revenue Sharing

8. The federal government shares its vast resources with states and LA's through an intricate system of grants. Grants under the federal constitution are (i) the capitation grant, which is discussed below;(ii) the road grant, which is determined by multiplying the state average maintenance cost by the road mileage in the state; (iii) the state reserve fund to help defray specific projects cost in states that face deficit in their operating accounts and to support the poorest states; (iv) assignment of export duty on tin and mineral exports; (v) contribution in aid of rates on federal and state property; (vi) special grants and assignment of revenue to Sabah and Sarawak; (vii) grants for the operating

costs of programs on the concurrent list (including the grant for launching local authorities, 1976).

9. Grants under Statutory Laws consist of (Viii) the revenue growth grant, which enables the states to benefit from any additionality in the federal revenue growth; (ix) the special annual grant to the state of Selangor for loss of revenue from land now under the Federal Territory of Kuala Lumpur; and (x) the annual grant to local authorities under the equalization formula.

10. Other forms of financial assistance are (xi) advances from the states' Trust Fund, (xii) launching grants to local authorities for buying capital equipment etc, (xiii) public low-cost housing assistance; (xiv) the grant element built in federal government loans to the states for public housing, water supply, and SEDC projects; and (xv) service charge that states can claim for supporting federal projects.

11. In addition, the federal government helps the states to fund (xvi) public amenities in rural areas and (xvii) pays royalty to states. For petroleum and natural gas, the states of Sabah, Sarawak and Trengganu receive a royalty of 5 percent of gross income but timber royalties accrue entirely to the states.

12. The capitation grant is the most important of the seven grants listed above. The structure is reported in Table 5A.1.1, which also reports the progressivity introduced in the capitation grant structure following the reform of 1992.

Table 5A.1.1: The Structure of Per Capita Grant in Federal-State Finances

1981 Structure	
First 100,000 persons	RM20 per person
Next 150,000 persons	RM10 per person
Next 250,000 persons	RM6 per person
For the remainder	RM 3 per person
1992 Structure	
First 50,000 persons	RM60 per person
Next 500,000 persons	RM8.50 per person
Next 500,000 persons	RM9.00 per person
For the remainder	RM9.50 per person

Source: Dato' Ali Abul Hassan bin Sulaiman, 1992, "Federal-State Relationship in Development Planning: Malaysia's Experience"

13. Another important source of direct federal assistance to the LA's is federal government's Local Authorities Grant under the State Grant Act 1981 is given to meet the deficit in the operating costs of local authorities. The grant amounts to 15 percent of the "fiscal reside" defined as the difference between a local authority's fiscal requirement and fiscal capacity (revenue already collected plus revenue to be collected).

Development Allocations

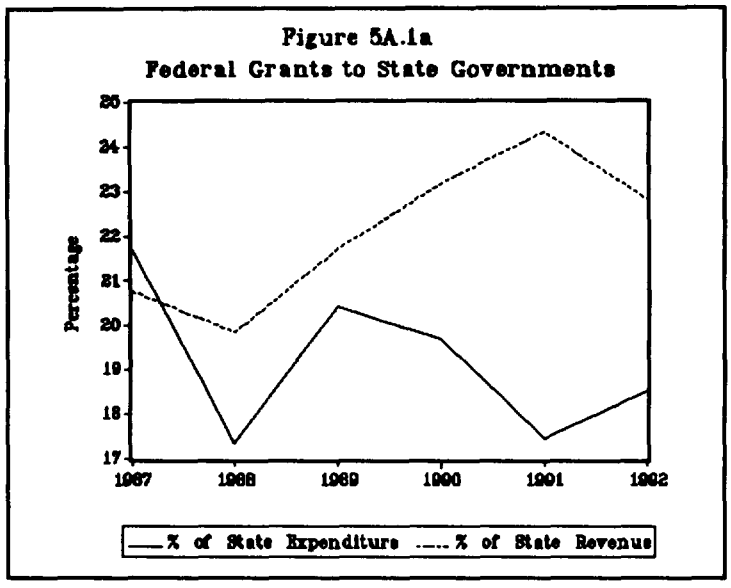
14. The balanced growth objective of the government is realized through its distribution of the development allocations. These allocations are substantial. For instance, in the Sixth Plan, a total RM19.2 billion were distributed among the states as development funds for state-specific projects for economic and social development and for security and administration upgrading. The State-wide distribution of development funds is given in Table 5A.1.2. These allocations are guided by a formula known as the priority or the stress ratio. It assigns weights to attributes representing the level of development of a state, which are then normalized into a common points scores. The scores are used to allocate development funds across states.

15. Straightforward correlations between ranking by plan allocations and by poverty incidence and state GDP are 0.34 and -0.79 respectively. This shows that the equity considerations in the stress ratio development allocations seem to be having their desired results.

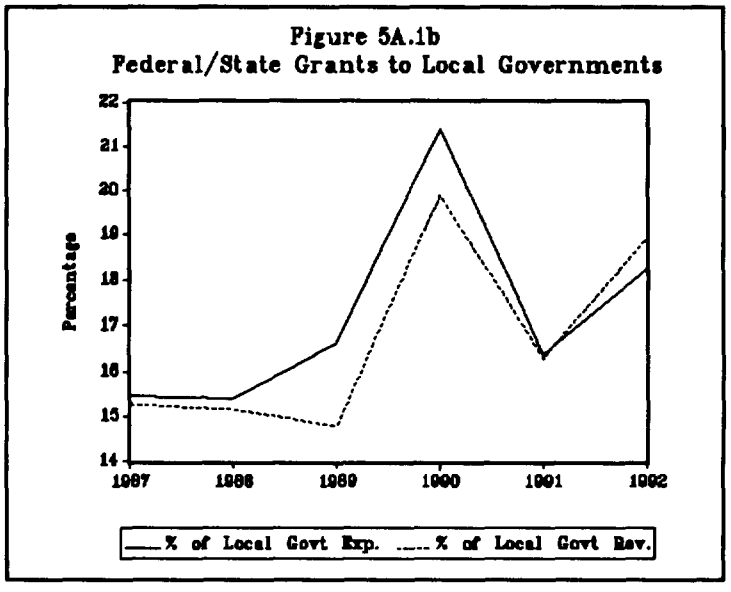
Table 5A.1.2: An Analysis of the Priority Ratio in Development Allocations

State	*Ranking by Sixth Plan Allocations*	*Ranking by Poverty Incidence*	*Ranking by State GDP*
Johor	12	10	4
Kedah	9	3	9
Kelantan	5	4	12
Melaka	2	8	13
Negeri Sembilan	3	11	11
Pahang	10	9	10
Perak	7	12	5
Perlis	1	6	14
Palau Pinang	3	7	7
Sabah	6	1	6
Sarawak	11	5	6
Selangor	13	13	2
Terengganu	8	2	8
Kuala Lumpur	14	14	3

Source: Bank reconstruction from Dato' Ali Abu Hassan; op cit.



Source: Table 5A.1.3



Source: Table 5A.1.3

Table 5A.1.3: Local Governments Consolidated Finance
(million ringgits)

	1985	*1986*	*1987*	*1988*	*1989*	*1990*	*1991*	*1992*	*1993*
1. Revenue	780.9	864.9	1100.7	1088.9	1400.2	1523.4	1516.5	1710.3	1819.4
(% change)		10.8	27.3	-1.1	28.6	8.8	-0.5	12.8	6.4
Own Revenue	515.9	567.0	914.8	915.2	1163.9	1186.9	1247.1	1371.8	1492.5
State and Federal Grants	265.0	280.3	167.6	165.2	206.6	302.9	246.7	323.4	311.9
Federal Reimbursement	0.0	17.6	18.3	8.5	29.7	33.6	22.7	15.1	15.0
2. Current Expenditure	541.0	590.0	811.3	903.2	994.7	1076.8	1116.8	1247.4	1156.7
(% change)		9.1	37.5	11.3	10.1	8.3	3.7	11.7	-7.3
3. Current Surplus/Deficit	239.9	274.9	289.4	185.7	405.5	446.6	399.7	462.9	662.7
4. Net Development Expenditure	310.0	306.0	275.9	168.9	251.1	339.1	394.5	527.3	458.8
(% change)		-1.3	-9.8	-38.8	48.7	35.0	16.3	33.7	-13.0
5. Overall Balance	-70.1	-31.1	13.5	16.8	154.4	107.5	5.2	-64.4	203.9
Source of Financing	70.1	31.1	-13.5	-16.8	-154.4	-107.5	-5.2	64.4	-189.9
Net Federal Loan	5.4	103.1	-9.1	-9.2	3.2	-12.9	-13.1	-12.6	-12.6
Net State Loan	11.4	75.5	11.2	-10.1	4.1	6.1	-11.1	28.0	28.2
Change in Assets	53.3	-147.5	-15.6	2.5	-161.7	-100.7	19.0	49.0	-205.5

Source: Treasury

Table 5A.1.4: Federal, State and Local Governments Shares in Combined Government Revenue

Year	*Federal Revenue*	*State Revenue*	*Local Govt. Revenue*
1987	79.8	16.2	4.0
1988	81.9	14.7	3.4
1989	82.2	14.1	3.8
1990	83.2	13.4	3.3
1991	86.4	10.4	3.2
1992	87.5	9.3	3.2

a. Latest estimates
b. Estimates

Source: Economic Report 1992/93, Ministry of Finance, Malaysia

Table 5A.1.5: Federal Expenditure on Grants to the State and Local Governments
(Percentage)

	State Governments		*Local Governments*	
Year	*Total Grant/ Total Exp.*	*Total Grant/ Revenue*	*Total Grant/ Total Exp.*	*Total Grant/ Revenue*
1987	21.7	20.8	15.5	15.3
1988	17.4	19.8	15.4	15.2
1989	20.4	21.7	16.6	14.8
1990	19.7	23.2	21.4	19.9
1991	17.5	24.3	16.3	16.3
1992	18.5	22.8	18.3	18.9

Note: Total grant to State Governments includes grants from the Federal Government only and total grant to Local Government includes grants from both the Federal and State Governments.

a. Latest estimates
b. Estimates

Source: Economic Report 1992/93, Ministry of Finance, Malaysia.

Table 5A.1.6: Relative Size of Revenue and Expenditure by Level of Government
(Ringgits, at constant 1985 prices)

	Per Capita Investment		Per Capita Investment		Per Capita Investment	
Level of Government	*1985*	*1992*	*1985*	*1992*	*1985*	*199*
Federal Govt.	1,280	1,522	456	435	1,347	1,71
State Govt.	174	172	137	127	201	18
Local Authorities	35	46	20	19	33	6

Source: Economic Report 1992/93 and 1990/91, Ministry of Finance, Malaysia.

Table 5A.1.7: Federal Government Development Allocation and Expenditure by State
($ Million)

	5MP				*6MP*	
State	*Revised Allocation*	*(%)*	*Expenditure*	*(%)*	*Allocation*	*(%)*
Johor	2,658	7.1	2,479	7.0	3,794	6.9
Kedah	2,363	6.3	2,255	6.4	2,826	5.1
Kelantan	1,933	5.2	1,795	5.1	2,064	3.8
Melaka	378	1.0	338	1.0	924	1.7
Negeri Sembilan	911	2.4	779	2.2	1,548	2.8
Pahang	2,496	6.7	2,103	6.0	2,837	5.2
Perak	2,054	5.5	1,870	5.3	2,563	4.7
Perlis	421	1.1	374	1.1	505	0.9
Pulau Pinang	725	1.9	678	1.9	1,548	2.8
Sabah	2,253	6.0	2,083	5.9	2,307	4.2
Sarawak	1,946	5.2	1,839	5.2	3,209	5.8
Selangor	2,288	6.1	2,024	5.7	4,295	7.8
Terengganu	2,063	5.5	2,014	5.7	2,729	5.0
Wilayah Persekutuan	2,228	6.0	2,104	6.0	4,608	8.4
Multi-State[1]	12,566	33.7	12,565	35.6	19,243	35.0
Total	37,290	100.	35,300	100.	55,000	100.

Source: "Sixth Malaysia Plan 1991-1995".

Note: 1. Multi-state projects are those whose beneficiaries are nation-wide and whose locations cannot be determined.

Appendix V.2

Malaysia's Past Experience With Privatization

1. Malaysia's past experience with privatization has been good and prepares it well for the current phase of expanding the role of private sector in the economy. However, there are important lessons to be learned to fulfill the objectives of the privatization master plan.

2. The Privatization policy was announced in 1983, following the high levels of fiscal deficits (that reached 19%, Government expenditure: 49% of GNP). The stated objectives were: (i) to increase the role of private sector in the development of the economy; (ii) to reduce the government's financial burden and (iii) to improve productivity and efficiency of the privatized enterprises (Mid-Term Review of the Fourth Malaysia Plan). By 1991, the concept was refined to read: "privatization is defined as the transfer to the private sector of activities and functions which have traditionally rested with the public sector".

3. By the end of 1990, 106 public enterprises had been privatized, including 11 departmental activities, 10 new projects, one activity of a statutory body, 84 government companies (70 were sold to wholly Bumiputera interests). These enterprises included commercial and manufacturing operations (82) and infrastructure and utilities (10). Of these, 70 were sold to Bumiputera interests, which were also represented in the sale of the major ones such as Sports Toto, Malaysian Airline System, Malaysian International Shipping Corporation, Kelang Container terminal and Syarikat Telecom Malaysia.

Some Observations:

4. A recent paper, "Welfare Consequences of Selling Public Enterprises: The Case of Malaysia" (Leroy Jones and Fadzil Azim Abbas, 1992) attempts to measure the welfare consequences of three important cases of privatization. The paper attempts to evaluate gains and losses from privatization. The methodological approach is to test the counterfactual, "Would gains have come about even without the divestiture?". The three cases considered are:

5. Malaysia Airline System. This involved partial financial divestiture since the government sold its shares but retained control.

6. Klang Container Terminal. This was a partial sale of a lucrative branch of the port business.

7. Sports TOTO. This involved an outright sale of a highly profitable public lottery.

8. Table 5A.2.1 below presents the salient welfare effects of the privatization.

Table 5A.2.1 An Evaluation of Three Malaysian Privatized Entities

Performance Criteria	*Malaysia Airlines System*	*Kelang Container Terminal*	*Sports Toto*
Financial Performance	Up	Up	Up
Government revenue	Up	Up	Up
Management improvement	yes	Up	?
Share prices	Up	?	?
Consumer welfare gain			
Locals	Down	?	?
Foreigners	Up		

Source: Constructed from Leroy Jones and Fadzil Azim Abbas, 1992," Welfare Consequences of Selling Public Enterprises: the case of Malaysia".

9. Malaysia's privatization performance compares quite well with other countries. Table 5A.2.2 shows welfare gains[y] from privatization in Malaysia in similar enterprises compared to United Kingdom, Chile and Mexico. The average welfare gain in Malaysia at 32.1 percent is the second highest in the four countries that have privatized similar entities recently.

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[y] Measured as the annual component of perpetuity equivalent of the welfare change, expressed as percentage of annual sales in the last pre-divestiture year.

Table 5A.2.2: Gains From Privatization: A Comparative Perspective

Country	*Industry*	*Welfare gain %*
U.K	Telecom	12.0
U.K	Airways	1.6
U.K	Freight	4.3
	Average	6.0
Mexico	Telecom	50.7
Mexico	Airline: Mexicana	-7.0
Mexico	Airline: AeroMexico	48.5
	Average	30.7
Chile	Electricity generation	2.1
Chile	Electricity distribution	5.2
Chile	Telecom	155
	Average	54.1
Malaysia	Malaysian Airlines	22.1
Malaysia	Container Port	53.4
Malaysia	Sports Toto lottery	10.9
	Average	32.1

Source: Galal, Jones, Tandon and Vogelsang, 1992, "Welfare Consequences of Selling Public Enterprises: Synthesis of cases and Policy Summary"

Appendix V.3

Approaches To Improving Urban Services

Introduction

1. In order to reduce environmental pollution and its negative health consequences, services must be improved. In urban areas these include improving transit services (to reduce air pollution), sanitation, solid waste collection and disposal, and the better treatment of drinking water.

2. When providing of these services, Governments must make a number of important decisions. First, available resources have to be allocated over the various services. Second, within each service, funds have to be allocated over different urban areas. Also, because urban areas vary by population size, revenue base and socioeconomic conditions, level of service may vary, as will charges. Further, funds must be divided between prevention and treatment (as in the case of water, where the emphasis can vary from preventing pollution of the source water to intensely treating polluted input streams), investments must be staged for expand capacity (as for sewer networks), and institutions must be organized in a way to offer better service (as by involving the private sector).

3. Explicit or implicit decisions regarding these choices derive from a number of inputs into the planning process such as political, financial, technological and ideological considerations. One input which has been conspicuously underutilized is demand-side information, which could be extremely useful to the planning process. In fact, experts argue such information could contribute to better technical, financial and institutional decisions on choices about appropriate technology or level of service, monthly tariffs and connection fees where relevant, and the mode in which service is provided (UNDP/World Bank, 1992).

4. Before describing the elements of the demand-driven approach, previous approaches to providing of urban infrastructure will be reviewed. These approaches typify the evolution of decision-making regarding urban services in most developing countries. Such an overview is necessary to understand the reasons that have led to the growing consensus regarding the superiority of the demand driven approach.

Different Approaches to Providing Services

The Public Health Approach

5. The public health approach was based on a number of premises. These include (a) the Government was the appropriate provider of urban infrastructure because of the large externalities; (b) that most people were too poor to pay for improved services and (c) that because of equity considerations, Government resources had to be spread thinly. In practice, the immediacy of needs determined the allocation of resources between services (for example, water had

the highest priority followed most often by sanitation, solid waste collection and air quality improvements). Proven technologies (for example, conventional sewer systems in the case of sanitation) were used to prepare master plans to cover the entire urban area; and these were implemented until the financial resources were exhausted.

6. The outcome of the above approach was disappointing. In most countries, coverage was low, maintenance of the physical infrastructure was poor and environmental pollution was high.

The Affordability Approach

7. The disappointing outcome and the emergence of much tighter financial constraints forced authorities to gradually abandon it. Instead, they substituted with the Affordability Approach, which incorporated conscious decisions regarding pricing, cost recovery and level of service. On the basis of historical experience, they decided that people could generally afford to pay between 3%-5% percent of their incomes for water and sanitation services. This criterion was used to determine on the level of service that residents of a particular area could afford (for example, house connections or public standposts in the case of water or off-site or on-site systems in the case of sanitation) and the price to be charged. At the same time, the private sector was permitted to provide some of the services (e.g., the construction of infrastructure and the collection of solid waste) in order to improve efficiency and reduce the Government's burden.

8. Once again, however, results did not match expectations: Coverage did not increase significantly and in many instances, connections to the infrastructure provided were short of the target. At the same time, the problems of poor maintenance and malfunctioning infrastructure persisted.

The Demand Driven Approach

9. The demand-driven approach that emerged was based on two observations. The first, was theoretical -- that both the earlier approaches were supply-oriented and ignored demand: The second was empirical -- that many of the facilities were either not functioning or were underutilized. Thus, it was concluded that a policy and planning approach (that incorporates demand issues) was needed that was based on a better understanding of what services people wanted and were willing to pay for.[9]

10. Providers of services must determine the demand for specific service levels at the proposed prices; and, in both of the earlier approaches, the planners' judgements, on behalf of the beneficiaries, were off the mark (accumulated experience suggests this problem is universal). For example, the assumption that households would automatically subscribe to the services provided has frequently turned out to be too optimistic. As a result, the mismatch

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[9] World Bank, 1993.

between what is demanded and what is supplied leads to underutilization of services and thereby to inefficient use of resources. Thus, along with the judgement of planners, demand should be empirically investigated particularly since the cost of obtaining it is relatively low when compared to the size of investments in urban infrastructure.

11. The investigation of demand yields useful information about current practices and expenditures, priorities over different services, and beneficiaries' preferences as to whether services should be private or public and if the latter, provided by the local or central government, over different institutional arrangements. In addition, the information is useful for planning the staged expansion of infrastructure services which are intended for future needs (for example, sewer networks and mass transit systems). With the increasing participation of the private sector in providing urban services, demand-side information becomes even more essential, in order for the Government to design appropriate regulations, in addition, should the government provide the service itself, it may initiate cost to recovery schemes and thus will need market surveys to determine the public's willingness to pay.

12. Another feature of the demand-driven approach is that it paves the way for communities themselves to provide and operate services -- a move that has met with striking success in extending services to areas where there was little possibility earlier. Thus, it is essential to devise methods to find out what services people want and are willing to pay for.

13. Increasingly the willingness-to-pay method is used by the public sector to obtain relevant information (technically called the contingent valuation method), and is included as a part of more general household surveys. It is analogous to market surveys used by the private sector for various products but is designed to obtain information about non-marketed goods or services.[7] The method was pioneered in developed countries with funding from their environmental protection agencies to assess public concern over air and water for which public money had to be allocated and which therefore required cost-benefit analyses. The method has subsequently been adapted with the help of research funding from the World Bank to assess demand for environmental services in developing countries.

14. Of course, it is not necessary that all decisions be based exclusively on the demand information obtained from willingness-to-pay studies. However, one of the strengths of the approach is that it helps identify important gaps between expert and public opinion. Such gaps result in poorly concerned and executed programs. Because public opinion is often based on limited or incomplete information, the population to be affected must be educated, in order to overcome indifference or resistance to programs that would ultimately be in the public interest.

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[7] For details of the method, see Mitchell and Carson, 1989.

Application of the Demand Driven Approach

15. The most extended application of the demand-driven approach to infrastructure planning in urban areas is the strategic-sanitation approach promoted by the World Bank for sanitation services.[8] This is particularly relevant for Malaysia because it is launch a massive urban sanitation program and because inadequate sanitation is one of the most serious environmental problems it faces today.

16. In its simplest form, the strategic-sanitation approach entails four basic steps:

(a) mapping the full set of feasible supply options available in the service area;

(b) assessing demand (that is, finding out what services consumers want and are willing to pay for);

(c) matching supply and demand into an affordable set of choices; and

(d) shaping service institutions and financial resources to implement the demand-oriented set of services.

17. Attempts to respond to consumer demand have led to the development of lower-cost supply options which mitigate the high cost of conventional sewerage systems. These include not only on-site systems like improved pit latrines and pour flush latrines but intermediate sewer systems, as well. Examples of the latter are subdivided sewerage, flat grade sewerage, simplified sewerage, solids-free sewerage and condominial sewerage.[9]

18.Valuation surveys have provided information on what level of service consumers want (at the neighborhood level) and what they are willing to pay for it. The surveys have also yielded information on the degree to which beneficiaries are prepared to participate in the construction operation, and maintenance of the systems, thus identifying further possible reductions in the costs.[10]

19. Matching supply and demand with the willingness-to-pay information and cost data allows authorities plan the optimal mix of service levels in an urban area. Thus, while dense city centers may be sewered for public health reasons (possibly over-riding low willingness to pay), outlying areas where land is available for drain fields might be served by on-site systems. Other areas in the city might be served by some form of intermediate sewerage system that can be upgraded in the future as demand develops.[11]

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[8] World Bank, 1992.

[9] World Bank, 1992, Chapter 2.

[10] Ibid., Chapter 3.

[11] Ibid., Chapter 4.

20. This procedure works well with urban zones or entire local areas that might not be prime candidates for improved services but which could signal their willingness to contribute their own resources if a higher level of service is provided. Such was the case in Orangi, a low-income township of approximately 1 million inhabitants in Karachi, Pakistan, which depended on bucket latrines and individual septic tanks and had virtually no chance of being served by the public sewer network in the foreseeable future. However, between 1981 and 1989, the people of Orangi spent Rs. 47.5 million (1 US$ equaled 15 to 20 rupees during this period) of their own money to construct 4,095 sewerage lines, 257 secondary drains and 63,191 sanitary latrines. By 1989, 87.3% of the streets in the project area had underground sewerage and 88.9% of houses had sanitary latrines. Even more impressive, the cost was reduced to one-sixth of the conventional contractor's rate. Thus, the public paid for the service that would have been provided with an investment of Rs. 285 million by the municipal corporation (OPP, 1989). Given that Orangi township is larger than many secondary cities in developing countries, the experience suggests it is possible to improve services despite constrained public funds if communities are willing to pay for and participate in feeder services.

21. The World Bank's favoring the demand-driven approach is based on the remarkable success such projects have had in providing sanitation services where it had not been thought possible (Orangi; Brazil).[12] More recent experience with urban drainage projects in Mexico, which is being adapted in other Latin American countries, further underscores the potential of the approach.[13]

22. The strategic-sanitation-approach developed by the World Bank includes guidelines for organizational frameworks, mechanisms for private sector and community involvement, as well as for financing and cost recovery, legal aspects, and procedures for selecting communities or local areas to receive improved services.[14]

23. Various components of this approach have been studied in Kumasi, Ghana,[15] Gujranwala, Pakistan,[16] and Ouagadougou, Burkina Faso.[17] Based on the information obtained, it appears that sanitation plans were developed and are currently being implemented in Kumasi and Ouagadougou.

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[12] See World Bank, 1992b, Chapter 5.

[13] Wall Street Journal, Friday, January 8, 1993, page 1.

[14] Helpful details regarding these aspects of service provision can be found in the handbook being prepared by the World Bank (1993).

[15] Whittington et al, 1992.

[16] Altaf, 1992.

[17] Altaf and Hughes, 1992.

Appendix V.4

SURVEY: QUALITY OF URBAN SERVICES AND ENVIRONMENT

INTRODUCTION: The Government of Malaysia through the Economic Planning Unit, Prime Minister's Department, has asked the World Bank to prepare a report on urban pollution in the country. this report would help the Government in its planning to improve the provision of services to the people. To prepare the report the World Bank would like to find out the views and preferences of the people about the level and quality of existing urban services. We would be grateful if you would kindly give us five minutes of your time to answer a few questions. Your name or address would not be recorded so that your answers would remain confidential. We thank you for your kind cooperation.

EXISTING SERVICES

1. What kind of sanitation facility do you have at present?

(i) Connected to Sewer system (ii) Communal Septic Tank (iii) Individual Septic Tank (iv) Other (Specify)

2. Are you having any problems with the existing arrangement?

(i) No Problems (ii) Some Problems (iii) Lot of Problems

3. What is the average approximate expenditure on the existing arrangement?
$_____ per _____

4. Do you consider this expenditure to be:

(i) Very Reasonable (ii) Reasonable (iii) Unreasonable

5. Are you satisfied with the collection of solid waste from your house?

(i) Yes (ii) No - Reason

6. Are you satisfied with the disposal of solid waste from your neighborhood?

(i) Yes (ii) No - Reason

7. Who do you feel can provide sanitation and solid waste services more efficiently?

(i) Municipality (ii) Private Sector (Why?)

ENVIRONMENTAL QUALITY: We would now like to find out your views on improving the quality of the environment in Kuala Lumpur. Household sewage, wastewater and solid waste all contribute to the pollution of water and soil which have to be cleaned up to prevent the spread of diseases. Travel by motor vehicles contributes to the deterioration of air quality.

8. What in your view is the major cause of environmental pollution in Kuala Lumpur? _____

9. At this stage of the country's development how important is it to you that resources be spent on further improving environmental conditions in Kuala Lumpur?

(i) Very important (ii) Fairly important (iii) Not very important

10. Improving the environment is expensive and requires plants for the treatment of sewerage and drinking water, landfills or incinerators for the disposal of solid waste, and emission control devices for motor vehicles. It also requires resources for monitoring and enforcement of regulations and prosecution of defaulters. At the same time improving the environment results in the provision of better quality services to households. If the Government sets up an environment fund to improve the quality of air, water sewer and solid waste disposal services in Kuala Lumpur how much would yo be willing to contribute per month to such a fund? RM_____

11. In percentage form how would you like this amount to be allocated:

(i) Improved Sewer Services _____%
(ii) Improved Solid Waste Collection and Disposal _____%
(iii) Improved Water Quality _____%
(iv) Improved Air Quality _____%

OTHER QUESTIONS

12. What is your age? _____Years

13. How many years of schooling have you had?_____Years

14. What is the annual assessment value of your house?RM _____

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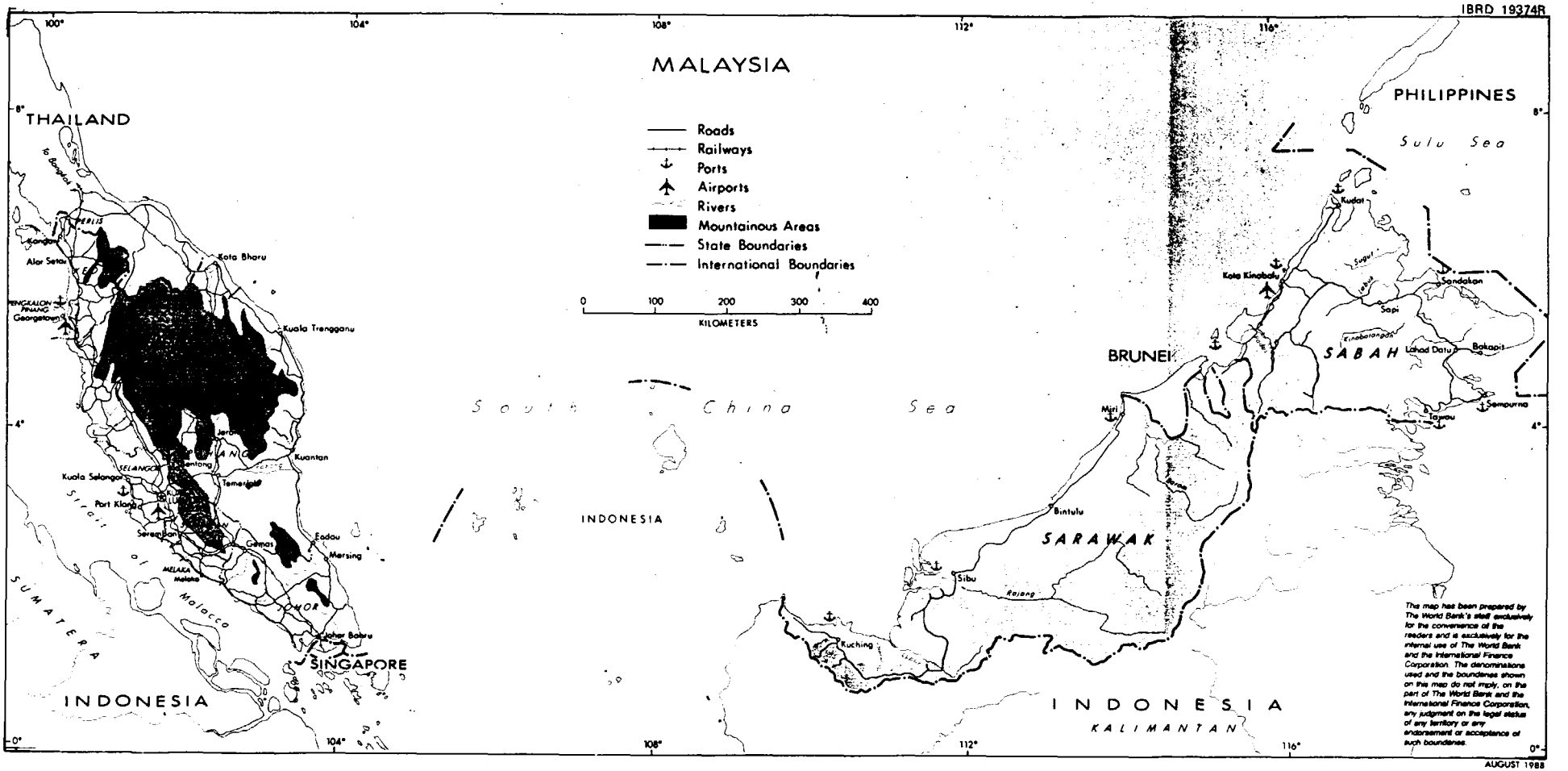
NOTES

MAP SECTION

IBRD 19374R



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