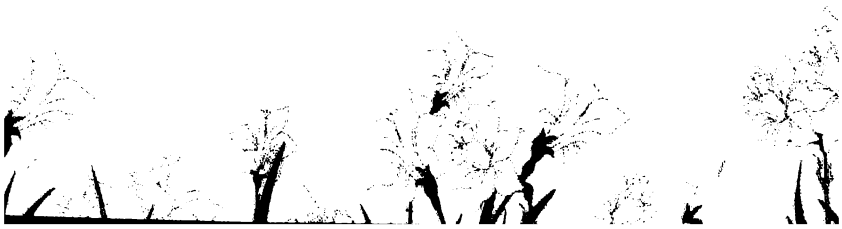
# Environment and Sustainable Development

Lok Sabha Secretariat
New Delhi
2000

*Environmental concerns have been an integral part of Indian traditions as reflected in the* Upanishads *which first stressed the need for conservation and sustainable use of natural resources two thousand years ago. These concerns are evident in our Constitution under the Directive Principles of State Policy.*

*–G.M.C. Balayogi*



# ENVIRONMENT AND SUSTAINABLE DEVELOPMENT


LOK SABHA SECRETARIAT
NEW DELHI
2000

No. 17/PRIS(POL)/LARRDIS/2000



Published under Rule 382 of the Rules of Procedure and Conduct of Business in Lok Sabha (Ninth Edition), 2000 and printed by Jainco Art India, New Delhi-110 005.

# PREFACE

The concept of sustainable development has, over the years, assumed phenomenal importance at the global, national and local levels. It is no more a static concept concerning only the environment; rather, it is a dynamic, long-term process, involving social and economic development as essential elements, leading to improved quality of life for all human beings.

During the last century, most countries in the Asia-Pacific region have undergone unparalleled social, political and economic transformation. The combination of high population density and growth, rapid industrialization and urbanization and poverty has taken its toll on the region's natural base, accelerated environmental degradation and led to a substantial increase in air and water pollution.

To promote parliamentary measures for sustainable development, the Asia-Pacific Parliamentarians' Conference on Environment and Development (APPCED)—an inter-parliamentary forum of parliamentarians in the Asia-Pacific region—was set up in 1992. Starting with eight countries in 1993, the APPCED today has grown to forty-six countries of the Asia-Pacific as its members. A wide array of environmental issues, including ocean, forestry, environmentally sound technology transfer and sustainable development of tourism have been deliberated during the past six Conferences.

The Seventh APPCED was held at Chiang Mai, Thailand from 20 to 22 November 1999. The Conference, with its main theme "Waste Treatment and Garbage Disposal in the City" was attended by parliamentarians from twenty-four countries of the Asia-Pacific region. The Indian Parliamentary Delegation to the Conference was led by the Speaker, Lok Sabha, Shri G.M.C. Balayogi.

During the Conference, the Speaker, Shri G.M.C. Balayogi presented a Country Report on Sustainable Development in the context of Environment and Development in respect of India. The Report highlighted the various projects and programmes initiated and promoted by the Government of India to integrate environmental concerns into the decision-making process. The Report, among other things, emphasised the need for a balance between developmental activities and their impact on environmental quality so that welfare of the society is maintained on a long-term basis.

Considering the topicality and immediate relevance of the subject, and also the fact that the Eighth APPCED will be hosted by India in November 2000, it was thought appropriate to bring out a brochure covering the Address by the Speaker, Lok Sabha to the Conference and the Country Report presented by him at Chiang Mai. For wider dissemination of information on the global trends in the field, brief summaries of Country Reports presented by various Delegations at the Seventh APPCED have also been included in the brochure.

We would like to place on record a special note of appreciation of the cooperation extended by the Ministry of Environment and Forests in finalising the Country Report in respect of India.

It is hoped that the brochure will be found informative by parliamentarians and all those interested in the preservation and protection of environment in a sustainable way.

G.C. MALHOTRA
*Secretary-General*
*Lok Sabha*

New Delhi,
July 2000

# CONTENTS

# ADDRESS BY THE SPEAKER, LOK SABHA AT THE SEVENTH APPCED AND COUNTRY REPORT IN RESPECT OF INDIA

The Speaker, Lok Sabha, Shri G.M.C. Balayogi addressing the APPCED held at Chiang Mai, Thailand

Distinguished Parliamentarians who attended the Seventh APPCED at Chiang Mai, Thailand

# ADDRESS BY THE SPEAKER, LOK SABHA, SHRI G.M.C. BALAYOGI AT THE SEVENTH APPCED

---

*Honourable Delegates:*

As you are aware, India would be hosting the next year's Millennium Conference of the APPCED. The Conference could be held tentatively sometime in the first fortnight of November 2000.

As a former Minister of Education in my home State of Andhra Pradesh in India, I have always had a feeling that there is a dire need to educate people in areas connected with environment and development. The theme of the Eighth Conference may be, if you all agree, Public Education, Environment and Development. The exact venue and dates of the next Conference would be finalised in consultation with the President of the APPCED and intimated to you.

Meanwhile, I have the honour to extend, on behalf of the Parliament of India and on my own behalf, a warm invitation to all the honourable delegates of the Parliaments of the countries participating in this Conference and also of those countries of the APPCED who are not present here. Formal invitations would be sent in due course.

I take this opportunity in extending my warm felicitations to His Excellency, Mr. Wan Muhammad Noor Matha, Honourable President of the National Assembly, his colleagues and his dedicated team of staff for making excellent arrangements for the successful organisation of this Conference in this beautiful city of Chiang Mai. Every care has been taken by the hosts for making our stay comfortable, pleasant and enjoyable. I hope the whole House—all the distinguished delegates present here—would join me in appreciating and applauding the sincere and painstaking efforts of the organisers.

Now I begin to make my presentation.

A Country Report in respect of India on Sustainable Development in the context of Environment and Development has already been circulated amongst the delegates. The Report extensively details diverse aspects of the core theme. I would like to restrict myself to some of the important components of the strategies we have adopted to address the issue.

Environmental concerns have been an integral part of Indian traditions as reflected in the *Upanishads* which first stressed the need for conservation and sustainable use of natural resources two thousand years ago. These concerns are evident in our Constitution under the Directive Principles of State Policy which provide that the State shall endeavour to protect the environment and to safeguard the forests and wildlife of the country. Further, the Constitution provides that it shall be the fundamental duty of every citizen to protect and improve the natural environment.

The Constitution has assigned the responsibility of protecting the environment to the Union and State Governments. Some of the significant environmental protection laws enacted include the Environment (Protection) Act, 1986; the Air (Prevention and Control of Pollution) Act, 1981; and the Water (Prevention and Control of Pollution) Act, 1974. The Government of India's policy has been expressed in the form of statements on forestry, on the abatement of pollution, the national conservation strategy and the policy statement on environment and development. The spirit of Agenda 21 principles adopted at the Earth Summit of 1992 has already been incorporated in these policies.

Compliance with the conditions stipulated is being ensured by monitoring the progress of implementation of Environmental Management Plans. Conservation and management of resources for development are sought to be achieved through a combination of regulatory and market-based economic instruments. The role of major groups, including the NGOs, farmers and other communities is being strengthened by directly involving them in the process of identification, formulation and implementation of environmental programmes. The important role of capacity building, legal instruments and mass media for promoting public awareness is fully recognised.

One of the objectives of our Ninth Five-Year Plan, which is now under way, is to ensure environmental sustainability of the developmental process through social mobilisation and participation of people at all levels. The Plan strategy for the environment sector has been drawn up in accordance with the need to develop the required measures to protect the environment in such a way as to achieve sustainable development. This strategy relies more on initiatives and interventions through policies and programmes of different sectors, notably, Health and Family Welfare, Transport, Rural Development, Energy, Agriculture, Fertilizers and Chemicals, Urban Development and Education.

Prior environmental clearance of developmental projects based on Environmental Impact Assessment is being increasingly emphasised. Such clearance has been made mandatory for 29 specified categories of developmental processes. Several Area-Specific Programmes like the National River Conservation Programme and National Lake Conservation Programmes have been undertaken during the Ninth Plan. Special programmes have been formulated for the Himalayan Region, Coastal Regulation Zone and Islands for their integrated sustainable development with the rest of the country. The Plan also envisages Sector-Specific Programmes like strengthening the Central Pollution Control Board, implementing Industrial Pollution Prevention Project and the Common Effluent Treatment Plan.

Besides, a scheme for promoting the development and adoption of cleaner technology, including waste water re-use and re-cycling, has been formulated. Environment statistics and mapping are also part of the Ninth Plan. To conserve the representative ecosystem, a Biosphere Reserve Programme is being implemented. Programmes have also been launched for management conservation of wetlands, mangroves and coral reef systems. A National Policy and Macrolevel Action Strategy on Biological Diversity has been drawn up as a statement of strategies, gaps in our planning and further actions needed for conservation, sustainable use and realisation of actual and potential value of biological diversity.

The hope for the future of environment in our country is based on many positive factors — our rich biological diversity and natural resources, increasing number of peoples' movements focusing on environment, greater public and media concern for these issues and the spread of environmental awareness among children and youth.

Thank you.

# SUSTAINABLE DEVELOPMENT IN THE CONTEXT OF ENVIRONMENT AND DEVELOPMENT
# INDIA—A COUNTRY REPORT

## Introduction

The accelerated growth of economic activities and the increase in global population have resulted in increasing environmental degradation in almost all the countries. Environmental degradation is the result of the dynamic inter-play of socio-economic, institutional and technological activities. Environmental changes may be driven by many factors, including economic growth, population growth, urbanization, intensification of agriculture, rising energy use and transportation. Poverty still remains at the root of several environmental problems. The global problems of ozone depletion, loss of biodiversity, depletion of natural resources and desertification are examples of environmental unsustainability.

Economic development without environmental considerations can cause serious environmental damage, thus impairing the quality of life of present and future generations. Sustainable development attempts to strike a balance between the demands of economic development and the need for protection of the environment. It seeks to combine the elements of economic efficiency, inter-generational equity, social concerns and environmental protection.

Sustainable development was defined by the 1987 Brundtland Commission as the meeting of the needs of the present without compromising the ability of future generations to meet their own needs. The ideal of sustainable development is harmonisation between economic growth and environmental preservation. The goal is to maximize simultaneously the biological system goals (genetic diversity, resilience, biological productivity), economic system goals (satisfaction of basic needs, enhancement of equity, increasing useful goods and services) and social system goals (cultural diversity, institutional sustainability, social justice, participation, etc.)

Sustainable development is about the future. It is about leaving the next generation a similar or better legacy of resources than that which was inherited. It means taking only the sustainable yield from renewable resources and honouring the environment's limited capacity to absorb waste. It means using exhaustible resources wisely so that, as they are depleted, the profits from their use are reinvested in technology and other forms of capital wealth.

Sustainable development is not a static and dogmatic concept concerning only the environment. It is a dynamic long-term process, including social and economic development as essential elements, seen in perspectives that may change over time, leading to improved quality of life for all human beings and to the eradication of poverty and the reduction of inequality. The concept of sustainable development carries inherent tensions, in particular between, on the one hand short-term economic needs and expectations and the demands of political and social stability and on the other, the goal of long-term sustainability for future generations. Implementing sustainable development is, therefore, inevitably an incremental process which needs to be re-evaluated and reinforced as it proceeds.

## Sustainable Development in India

With its geographic, climatic and biological diversity, India has a unique environmental heritage. The country represents almost all types of habitats of the world and the land mass of the country and its water bodies sustain an extremely rich variety of plants and animals.

Environmental concerns have been an integral part of Indian traditions as reflected in the *Upanishads* which first stressed the need for conservation and sustainable use of natural resources two thousand years ago. These concerns are evident in the Constitution of India under the Directive Principles of State Policy which provide that the State shall endeavour to protect the environment and to safeguard the forests and wildlife of the country. Further, the Constitution provides that it shall be the fundamental duty of every citizen to protect and improve the natural environment, including forests, lakes, rivers and wildlife. By a Constitutional Amendment in 1976, the subject of forest and wildlife was brought under the Concurrent List in the Seventh Schedule, thereby enabling Central as well as the State Governments to legislate on these subjects. The roots of the growing trend towards popular participation in the conservation and natural resource development programmes lie in these constitutional provisions.

In India, the Ministry of Environment & Forests is the nodal agency responsible for the protection, conservation and development of environment. The Ministry works in close collaboration with other Ministries, State Governments, Pollution Control Boards and a number of scientific and technical institutions, universities, non-governmental organisations, etc.

India is of the view that environmental protection cannot be isolated from the general issues of development and must be viewed as an integral part of developmental efforts. Various efforts have been made to integrate environmental concerns into the decision-making process. Environmental standards and environmental management plans prescribed are important measures taken to protect environment. The same applies to environment audit which is being made mandatory for major industries. Environment protection does not only involve a prevention of pollution and of natural resource degradation, but has to be integrated with the overall development process and the well-being of the people.

## Carrying Capacity

It is now accepted that in terms of natural resources, a country's demand for its sustenance should not exceed its carrying capacity. Sustainable development calls for a balance between development activities and their impact on environment quality so that the welfare of the society is maintained on a long-term basis. The concept of "Carrying Capacity" is not new and yet, efforts to extend the same in the realm of developmental planning are few. Environment, with its biotic and abiotic components, provides the basic resources and supports the production-consumption activities and assimilates residues generated during the course of these activities. The limits to development are, therefore, defined by the supportive and assimilative capacity of the planning region. The important components of Carrying Capacity-based developmental planning are estimation of supportive and assimilative capacities and optimal allocation of resource base to various socio-economic activities.

Carrying Capacity studies have been initiated in typical problem areas with a high degree of replication in many parts of the country. These studies are aimed at evolving development portfolios for sustainable development keeping in view the following:

- Cumulative environmental impacts of development projects;
- Demarcating environmentally sensitive and fragile areas needing protection; and
- Optimisation of limited natural resources for achieving a better quality of life.

Over the last few decades, India has evolved legislations, policies and programmes for environmental protection and conservation of natural resources. The Government of India's policy has been expressed in the form of statements on forestry, on the abatement of pollution, the national conservation strategy and the policy statement on environment and development. The spirit of Agenda 21 principles adopted at the Earth Summit of 1992 held in Rio de Janeiro has already been incorporated in these policies. For instance, with regard to the social and economic dimensions of Agenda 21, India has become a signatory to the Montreal Protocol for phasing out ozone depleting substances, the Basel Convention on trans-boundary hazardous substances, the Convention on biological-diversity, climate change and other international treaties. Similarly, poverty alleviation programmes have been launched wherein family planning and welfare are a major focus. Environmental concerns are being integrated in decision-making as well.

Compliance with the conditions stipulated is being ensured by monitoring the progress of implementation of Environmental Management Plans. Conservation and management of resources for development are sought to be achieved through a combination of regulatory and market-based economic instruments. The role of major groups, including the NGOs, farmers and other communities is being strengthened by directly involving them in the process of identification, formulation and implementation of environmental programmes. The important role of capacity building, legal instruments and mass media for promoting public awareness is fully recognised.

The main environmental problems in India relate to air and water pollution, degradation of common property resources, threat to biological diversity, solid waste disposal and sanitation. Increasing deforestation, industrialisation, urbanisation, transportation and input-intensive agriculture are some of the other major causes of environmental problems being faced by the country. Poverty presents special problems for a heavily populated country with limited resources.

## Status of India's Environment

The Constitution of India has assigned the responsibility of protecting the environment to the Union and State Governments. Environmental protection laws have been enacted under the Environment (Protection) Act, 1986; the Air (Prevention and Control of Pollution) Act, 1981; and the Water (Prevention and Control of Pollution) Act, 1974. The Environmental (Protection) Act, 1986 has empowered the Central Pollution Control Board (CPCB) to lay down and maintain the ambient air quality and water quality standards, to demand information regarding effluent emissions, to shut down polluting activities and to prevent discharges of effluent and sewage.

## Air Quality

The urban areas represent complex environmental problems. The living conditions of millions of urban poor are such that they pose a threat to their health and have potentially catastrophic social consequences. For the urban poor, the living conditions are the worst. If these problems are not addressed in an effective and timely manner, serious environmental and associated health consequences will follow. Burgeoning urban population beyond the carrying capacity of the different components of urban eco-systems, coupled with indifferent urban governance, are the root causes for urban environmental problems. Air pollution can cause chronic and acute respiratory diseases, ventilatory malfunction, heart diseases, cancer of the lungs and even death.

## Water Resources and Water Quality

With the rapid increase in the population of the country and the need to meet the increasing demands of irrigation, human and industrial consumption, the available water resources in many parts of the country are getting depleted and the water quality has deteriorated. In India, water pollution comes from three main sources: domestic sewage, industrial effluents and run-off from agriculture. The most significant environmental problem and threat to public health in both rural and urban India is inadequate access to clean drinking water and sanitation facilities.

## Solid Wastes and Hazardous Chemicals

There has been a significant increase in the generation of domestic, urban and industrial wastes in the last few decades. Although a major part of the waste generated is non-hazardous, substantial quantities of hazardous waste is also generated. The growth of chemical industries has resulted in the extensive use of chemicals, which release huge quantities of wastes into the environment in the form of solids, liquids and gases.

## Land Degradation and Soil Loss

Soil erosion is the most serious cause of land degradation. The accumulation of salts and alkalinity affect the productivity of agricultural lands in arid and semi-arid regions which are under irrigation. Fertilisers and pesticides are important inputs for increasing agricultural production. Their use has increased significantly from the mid-60s. Overuse and unbalanced use of these chemicals are fraught with danger. Suitable agronomic practices will be helpful in this regard.

## Forests, Wildlife and Bio-diversity

Forests are important for maintaining ecological balance and preserving the life supporting system of the earth. They are essential for food production, health and other aspects of human survival and sustainable development. Indian forests constitute 2 per cent of the world's forest area but are forced to support 12 per cent of the world's human population and 14 per cent of the world's livestock population.

The National Forest Policy (1988) stipulates that a minimum of one-third of the total land area of the country should be brought under forest or tree cover. It is envisaged that this will be achieved by involving local stakeholders like farmers, tribals, women, NGOs and the Panchayat Raj Institutions (PRIs).

Another concern relating to the state of forest resources is that of biodiversity and extinction of species. India has a rich heritage of species and genetic strains of flora and fauna. For *in situ* conservation of biological diversity, India has developed a network of protected areas, including national parks, sanctuaries and biosphere reserves. This network, which is being progressively expanded, now covers

about 4 per cent of the total land area of the country. As a result of the amendments made in 1991 to the Wildlife (Protection) Act, hunting of all species of wild life for commerce or for pleasure has been banned.

## Strategy for the Ninth Five-Year Plan (1997-2002)

One of the objectives of the Ninth Five-Year Plan is to ensure environmental sustainability of the developmental process through social mobilisation and participation of people at all levels. The Ninth Plan is also based on the belief that the principal task of planning in a federal structure is to evolve a shared vision and commitment to the national objectives and development strategy. The Ninth Plan also lays greater stress on reorienting the policies than on direct intervention so as to signal and induce the various economic agents to function in a manner consistent with the national objectives.

The Ninth Plan strategy for the environment sector has been drawn up in accordance with the need to develop the required measures to protect the environment in such a way as to achieve sustainable development. The Ninth Plan recognises the symbiotic relationship between the tribals and the forests and gives a special focus to the tribals and other weaker sections living in and around the forests. A number of enabling conditions have been already created for harmonising economic growth and environmental conservation.

The strategy for the Ninth Plan is based on the belief that macro-economic stability is fundamental not only for economic growth but also for sound environmental management. The Ninth Plan envisages a multi-pronged strategy for sustainable development of the country.

## Important Elements of the Ninth Plan Strategy

- Empowering the people through information generation, dissemination and access.
- Involving the industry in both the private and the public sector.
- Integrating environment with decision-making through valuation of environmental impacts.
- Evolving market based economic instruments as an alternative to the command and control form of environmental regulation.

- Appropriate pricing of natural resources based on their long-term marginal cost of supply.
- Appropriate fiscal reforms and natural resource accounting.
- Evolving the rights for common property resources.
- Inter-sectoral coordination and cooperation.
- Ensuring scientific and technological inputs.
- Participation of people (particularly women) in the management and sharing of usufruct through Joint Forest Management.
- Involvement of NGOs for awareness building and as an interface between the Forest Department and the people to be encouraged.
- Integrated development of villages in and around forests.

## Programmes for the Ninth Five-Year Plan

Environmental protection requires both preventive and curative measures. The strategy for environmental protection in the Ninth Five-Year Plan relies more on initiatives and interventions through policies and programmes of different sectors, notably, Health and Family Welfare, Transport, Rural Development, Energy, Agriculture, Fertilizers and Chemicals, Urban Development and Education. The underlying logic is that curative treatment should come only as the last resort, the primary emphasis being placed on the preventive approach.

Energy sector is a major polluter. In order to minimise its adverse impact on environment, a number of steps have been taken. All major power projects are subjected to an environmental impact assessment. Environmental clearance is granted to them only after stipulating appropriate environment management plans. These are rigorously monitored for compliance. Relocation and rehabilitation plans and Catchment Area Treatment are an integral component of River Valley projects. A separate regulatory agency has been established for the nuclear power plants.

In the interest of transparency, it is stressed that the Annual Reports of the Department of Power, the Department of Coal and the Ministry of Petroleum and Natural Gas should give a balance sheet of carbon dioxide generated by their activities and counterpart sink created by them or through resources contributed by them. The Ministry of Petroleum and Natural Gas has also laid considerable stress on improving the quality of petroleum products, particularly automotive fuels like motor spirit and high speed diesel.

## Issue-Specific Programmes

### (i) People's Involvement and Role of Information

A challenging task is the mobilisation and involvement of the people in environmental protection. The Ninth Plan has already had a good beginning in this regard in the sense that through an amendment made on 10 April 1997 to the notification relating to Environmental Impact Assessment (EIA), a provision has been made for the process of public hearing. All important developmental activities, covered by the EIA Notification dated 27 January 1994, are covered by this amendment which provides that only after the due process of public hearing, can any major activity be undertaken. It is also significant that even under the delegation of powers to the State Governments under the Environmental (Protection) Act, the provision of public hearing is applicable. Another aspect is the setting up of the National Environment Appellate Authority which looks into complaints against environmental clearance accorded by the Central/State Governments.

Citizens Monitoring Committees are being established under the National River Conservation Programme. Specific schemes have been launched for involving people from all cross-sections of life ranging from students to retired soldiers in the gigantic task of environmental protection.

### (ii) Strengthening of the Surveillance and Monitoring System

A wide network of air and water quality monitoring stations has been established under the National Ambient Air Quality Management, Global Environmental Monitoring System and other programmes.

### (iii) Integrating Environmental concerns with Decision-Making

In order to lend a reasonable degree of rationality to the process of policy formulation and decision-making, the Ninth Plan lays specific emphasis on epidemiological studies and environmental economics. It is hoped that this would facilitate integration of such environmental concerns with the decision-making process.

## Area-Specific Programmes

### (i) National River Conservation Programme (NRCP)

The NRCP, aimed at implementing pollution abatement measures to conserve rivers which are the primary fresh water sources of the country, is being implemented in 141 towns in 14 States and covers 22 major rivers. This Plan was started during the Eighth Five-Year Plan and its forerunner, the Ganga Action Plan Phase-I, was started in 1985. The National River Conservation Plan which now includes the Ganga Action Plan Phase-II was initially a Centrally Sponsored Scheme with 50 per cent Central assistance. However, it was realised that many States were not in a position to match it with their own funds to the extent of 50 per cent. Therefore, during the Ninth Plan period, it has been decided to make it a 100 per cent Centrally Sponsored Scheme.

The Plan has an outlay of Rs. 2013.46 crore and the thrust areas of attention are as follows:

- Carrying out interception and diversion works designed to prevent the domestic sewage from out-falling into rivers, use of low cost and people friendly technology for sewage treatment plants with emphasis on microbial pollution abatement and encouraging the utilisation of treated sewage for irrigation, aquaculture and forests;
- Supervising the strict enforcement of environmental laws through the Pollution Control Boards to ensure the control of industrial pollutants;
- Enlisting the active involvement of the local bodies like municipalities in the construction and maintenance of interception and diversion works and sewage treatment plants; and
- Mobilising the participation of the public and 'self-help groups' in activities aimed at controlling the non-point sources of pollution.

**(ii) National Lake Conservation Programme (NLCP)**

Due to pressure of human activities, a number of lakes are shrinking or getting polluted beyond the point of recovery. The objective of the NLCP is to arrest further degradation of lakes and to revive these water bodies to acceptable environmental standards. On the recommendations of a National Committee under the Chairmanship of the Secretary of the Ministry of Environment and Forests, 21 urban lakes considered to be highly degraded were identified for conservation and management in 1993. Later, a Committee prioritised 11 lakes. However, the plan has not been approved yet and the Ministry of Environment and Forests is considering conservation of Dal Lake in Srinagar only to take up as a stand-alone project with internal resources.

**(iii) Himalayan Region**

In March 1992, an Expert Group was constituted by the Planning Commission to formulate a National Policy for the integrated development of the Himalayas. With a view to operationalising the recommendations of the Expert Group, a Steering Committee has been constituted by the Planning Commission.

For generating and strengthening the knowledge about the ecology and sustainable development of the Himalayas, the Ministry has set up the G.B. Pant Institute of Himalayan Environment and Development. This Institute has emerged as a focal agency to advance scientific knowledge to evolve integrated management strategies, demonstrate their efficacy for conservation of natural resources and to ensure environmentally sound development in the entire Indian Himalayan region. Towards this end, R&D activities have been undertaken by the Institute.

**(iv) Coastal Regulation Zone**

India has a long coastline with a total length of 7500 kms. The total number of islands is about 1197, which include the off shore islands of Andaman and Nicobar and Lakshadweep. The territorial waters of India have an extent of 155,889 sq. kms. This coastline harbours many ecologically sensitive flora and fauna and also supports the economy of the coastal people. In order to conserve and protect this coastal area, a Statutory Notification was issued which classifies the different areas of coast into ecologically sensitive areas, areas which have already been built up, and areas which are rural and which can be used for developmental activities. The Notification prohibits specifically some of the activities such as setting up of

industries and dumping of waste in the coastal areas. It also puts restrictions on drawal of groundwater from these areas. In 1998, a National Coastal Zone Management Authority was constituted for protecting and improving the quality of coastal environment and preventing, abating and controlling environmental pollution in coastal areas. In the coastal States also, similar authorities have been constituted. During the Ninth Plan, it is proposed to draw up an integrated coastal zone management plan which would *inter alia* take into account ecological concerns in the adjoining marine and land areas.

**(v) Islands**

With a view to recommending policies and programmes for the integrated, environmentally sustainable development of Andaman and Nicobar and the Lakshadweep groups of Islands, the Island Development Authority (IDA) was reconstituted in August 1998. The Authority, which is chaired by the Prime Minister, also reviews periodically the progress of implementation and impact of the programmes of development. Simultaneously, the Standing Committee of the IDA has also been reconstituted under the chairmanship of the Deputy Chairman, Planning Commission.

## Sector-Specific Programmes

**Environment**

The sub-strategy under this broad head for achieving the wider purpose consists of prevention of pollution at source; encouragement, development and application of the best available/feasible technological solutions; application of the "polluter pays" principle; focus on heavily polluted areas; and public participation.

**(i) Strengthening the Central Pollution Control Board**

The Central Pollution Control Board is the apex regulatory and enforcement agency. The programme areas for the Ninth Plan are proposed to be environmental monitoring and assessment of the pollution; environmental standards and action plans; enforcement of pollution abatement programme; and promotion of infrastructure and capacity upgradation programme.

Some of the highlights of the proposed activities are introduction of bio-monitoring for assessment of pollution and health of aquatic system, water quality monitoring in medium and small rivers, ground water quality monitoring, soil pollution monitoring, epidemiological studies for formulation of standards based on health considerations, environmental audit, promotion of infrastructure and capacity upgradation programme.

**(ii) Industrial Pollution Control and Prevention Projects**

After the successful conclusion of the Industrial Pollution Control Project, presently a Project on Industrial Pollution Prevention is being implemented with World Bank assistance. The proposed Project will strengthen four State Pollution Control Boards in respect of their facilities, equipment and skills to enable them to more effectively perform their mandate; facilitate priority investments dedicated to prevent pollution from industrial sources by encouraging use of clean technology; and provide technical assistance for waste minimisation and adoption of modern tools of information.

**(iii) The Common Effluent Treatment Plants (CETP)**

The CETP would be an important scheme for assisting in the setting up of common facilities for clusters of small scale units for treatment and disposal of solid, liquid and gaseous waste generated by small scale units located in industrial estates/clusters.

**(iv) Adoption of Clean Technologies in Small Scale Industries**

A scheme for promoting the development and adoption of clean technology, including waste water re-use and re-cycling, has been formulated for small scale industries. This scheme links research and development with diffusion and adoption of pollution prevention measures. Under this scheme, activities relating to demonstration of already proven clean technologies, preparation of sector-specific manuals on waste minimisation, setting up of waste minimisation circles in specific clusters of small scale industries and training and awareness programmes for personnel in small scale industries would be undertaken.

**(v) Environmental Statistics and Mapping**

The Ninth Plan proposes the preparation of statistical data base and reports on the status and the trends in environmental quality with reference to air, water, soil and noise and depicting them on an Atlas. It is also proposed to prepare a Zoning Atlas for locating industries in States. Environmental statistical cells are proposed to be set up in the Central as well as the State Pollution Control Boards.

**(vi) Environmental Impact Assessment**

Environmental Impact Assessment (EIA) is statutory for 29 selected activities which cause pollution, degradation of land, require resettlement and rehabilitation of local inhabitants, and/or require large quantity of resources like water and energy.

As mentioned earlier, as per the provisions of the Environmental Impact Assessment notification, which requires assessment of these projects, public hearings are statutory and the project proponents have to explain to the public the proposals. The proposals are finally examined by the Expert Committee and decisions are taken on that basis. During the Ninth Plan period, it is proposed to consolidate the achievements made in EIA and also extend it to more activities with stress on decentralisation and quality improvement.

The Ministry of Environment and Forests has also declared certain areas such as coastal zones as ecologically fragile and drawn up a detailed programme of action which include appraisal of developmental projects and conservation of nature.

**(vii) Development and Promotion of Cleaner Technologies**

The Indian industry today uses many obsolete technologies resulting in wastage of energy and raw materials, causing considerable pollution and producing wastes which cannot be utilized. End-of-pipe pollution control is an expensive strategy and has not been very successful. The real solution lies in switching over to Clean Technologies, which generate less pollution and higher output of productive goods and services.

With regard to development and promotion of cleaner technologies, the Ninth Plan envisages the taking up of demonstration projects for effective transfer of technologies. Partial funding for Demonstration Projects for the promotion of Cleaner Technologies requiring scaling up and/or commercialisation is provided under the Project.

**(viii) Biosphere Reserve Programme**

To conserve the representative ecosystems, a Biosphere Reserve Programme is being implemented. Eleven bio-diversity rich areas of the country have been designated as Biosphere Reserves applying the UNESCO/MAB criteria. These reserves aim at conserving the biological diversity and genetic integrity of plants, animals and micro-organisms in their totality as part of the natural eco-systems so as to ensure their self-prepetuation and unhindered evolution of the living resources.

Programmes have also been launched for scientific management and wise use of fragile eco-systems. Specific programmes for management and conservation of wetlands, mangroves and coral reef systems are also being implemented.

**(ix) Biodiversity Conservation**

India is one of the 12 mega biodiversity countries of the world. With only 2.4 per cent of the total land area of the world, the known biological diversity of India contributes 8 per cent to the known global biological diversity. From about 70 per cent of the total geographical area surveyed so far, 46,000 plant species and 81,000 animal species have been described by the Botanical Survey of India (BSI) and the Zoological Survey of India (ZSI), respectively. These life forms are actually and potentially important for developments in the fields of food, medicine, textiles, energy, recreation and tourism.

India became a Party to the International Convention on Biological Diversity (CBD) in May 1994. The three objectives of the Convention are: (i) conservation of biological diversity; (ii) sustainable use of components of biological diversity; and (iii) fair and equitable sharing of benefits arising out of the utilisation of genetic resources.

Pursuant to India's ratification of the CBD on 18 February 1994, steps have been initiated to meet the commitments/opportunities offered by it. The main implementation measures for the CBD are through national strategies, legislation, and administrative instruments to be developed in accordance with each country's particular conditions and capabilities.

Adopting a consultative process with the stakeholders, the National Policy and Macrolevel Action Strategy on Biological Diversity has been drawn up as a statement of strategies, gaps and further actions needed for conservation, sustainable use and realisation of actual and potential value of biological diversity. This plan aims at consolidating the on-going efforts of conservation and sustainable use of biological diversity, identifying gaps in various sectors, and providing a policy and programme regime to ensure attainment of the three objectives of the CBD. Concrete steps to turn the strategy into action are now being taken. Identifying critically important areas and gaps in taxonomic work, an All India Coordinated Project has been launched for prioritised purpose-oriented capacity building in taxonomy. To encourage taxonomic work, a national award in taxonomy is being instituted. Institutions with requisite strengths are being identified as Centres of Excellence in biodiversity to cover specific geographical areas. A Status Report on Biodiversity Conservation is also being finalised.

India's richness in biological resources and indigenous knowledge relating to them are well recognised. One of the major challenges before India lies in adopting an instrument which helps realise the objectives of equitable benefit sharing enshrined in the Convention. India has developed an outline of a biodiversity legislation which aims at regulating access to biological resources and making such access subject to terms and conditions which secure equitable sharing of benefits for the resources accessed. This has been done through a consultation process with the stakeholders, local people, industry, practitioners of indigenous systems of health care and medicine, technical and academic institutions, State Governments, institutions of self Government, trade and business. The outline of biodiversity legislation is under finalisation.

**(x) Research**

Scientific inputs are provided by National Research Institutes, Universities and NGOs under the guidance of expert groups and committees to enhance the quality and efficiency of programmes of the Government in protecting and improving the quality of the country's environmental and ecological resources.

**(xi) Policy and Law**

Grants are released to the State Pollution Control Boards and the Department of Environment of the State Governments with the objective of strengthening their technical capabilities. Due to various decisions of the Supreme Court and the High Courts, the responsibilities and commitments of the State Pollution Control Boards are increasing. Poor enforcement of regulations is a matter of concern. It is being increasingly felt that there is a need to strengthen the existing laws and legal instruments so as to ensure that the strengthened legal regime not only deals with environment related offences speedily and effectively but also acts as a deterrent. It is proposed to create a credible system of deterrence and a system of redressal relatable to environment protection through suitable amendments in the Environment Protection Act. The labelling of environment friendly products by granting ECOMARK helps in pollution abatement. This important activity would be considerably supported during the Ninth Plan.

### (xii) The National Environment Tribunal Act, 1995

The National Environment Tribunal Act, 1995 has already come into effect. The Principal Bench of the Tribunal will be located in New Delhi. The supporting infrastructure for this Tribunal will be provided during the Ninth Plan.

#### Forestry and Wildlife

The Programmes/Schemes of the Ninth Five-Year Plan are generally similar to those taken up during the Eighth Plan, such as Integrated Afforestation and Eco-Development Project, Fuelwood and Fodder Project Scheme, Non-Timber Forest Produce Scheme, Grants-in-Aid Scheme, Seed Development Scheme, etc., with greater focus and improved implementation on the basis of the experience gained during the Eighth Plan.

#### Wasteland Development

The Ninth Plan envisages regeneration of wastelands to release pressures on the forests and standardisation of the definition of wastelands, assessment of their magnitude and their development by a re-orientation of the policy of "open access" to "common property resources". Clear, quantified and phased arrangements would be evolved for an equitable sharing of the usufruct. The programmes/ schemes for Wasteland Development of the Ninth Five-Year Plan are generally similar to those taken up during the Eighth Plan such as Integrated Wastelands Development Projects Scheme, Technology Development Scheme, Training and Extention Scheme, Investment Promotional Scheme, etc.

The National Forest Policy, 1988 envisages massive afforestation and social forestry programmes on all denuded, degraded and unproductive lands. Approximately, 30 mha of non-forest wastelands are to be brought under tree cover.

#### Management of Solid Wastes and Related Issues

In India, solid waste management (SWM) is the function of urban local bodies. According to the 1991 census, 217 million persons out of the 844 million total population of the country were residing in the urban areas. By the year 2001, the urban population is expected to grow to 307 million, comprising more than 30 per cent of the total population of the country. In 1951, there were 3060 towns in the country. The number increased to 4029 in 1981 and by 1991 it became 4689.

Unregulated growth of urban areas without necessary infrastructural services and proper collection, transportation, treatment and disposal of solid wastes have resulted in increased pollution and health hazards. Waste generation in the cities ranges from 200 to 500 gms per capita per day depending upon the size of the city. The larger the city, the higher is the per capita generation of waste. By the year 2001, it is expected that waste generation in urban areas will exceed 39 million tonnes per year.

The major environmental concerns in an urbanising India relate to high levels of water pollution due to poor waste disposal, inadequate sewerage and drainage and improper disposal of industrial effluents. The dumping of solid waste in low-lying areas contributes to land and ground water pollution. All these developments have contributed to the deterioration of the urban environment, a critical concern that needs specific interventions for sustainability of human settlements.

With the objective of emphasising waste reduction and recycling and reuse in industries and better management of municipal solid wastes, a scheme to initiate setting up of pilot projects, conduct surveys and funding of promotional activities in the following areas has been initiated:

(i) Municipal solid wastes:

  (a) Survey of urban municipal wastes in important cities.

  (b) Setting up of pilot plants on utilisation of municipal solid wastes.

(ii) Setting up of pilot plants for utilisation of industrial wastes.

(iii) Development and other promotional activities for municipal and industrial wastes.

At present, solid wastes are utilised to the extent possible by the following processes:

- Conversion of garbage into energy pellets.
- Anaerobic digestion/biogas generation from garbage.
- Composting by vermiculture and other means.

The process of anaerobic digestion/biogas generation from garbage is being utilised at medium and small scale levels at several places in India, and is being encouraged in other places also. The conversion of garbage into compost by vermiculture and other processes is also being promoted. All these processes not only help in waste utilisation but also in producing energy or products of utility.

Apart from organic wastes, several other urban wastes such as waste papers, plastics, glass, rubber, textiles, metals, coconut shells, etc. are extensively recycled and their use is encouraged by the Government.

Some industrial wastes such as fly ash, blast furnace slag, lime sludge, phospho-gypsum, red-mud, etc. are generated in large quantities and are sources of environmental pollution. Re-use and recycling of these wastes is being encouraged. Fiscal incentives have been provided in the form of exemption of excise duty on production of building materials using fly ash or phospho-gypsum and exemption of customs duty on import of equipment and machinery for utilisation of these wastes for gainful purposes. The collection and disposal of solid wastes is another area of concern of city management in India.

In order to improve the management of urban solid wastes and sewage related issues, there is need for capacity building, awareness and training, improved technologies and the creation of infrastructural facilities. The lack of adequate financial resources, especially at the municipal and local levels, remains a constraint.

In 1996, the Supreme Court of India entertained a Writ Petition and the Apex Court felt it appropriate to constitute a Committee under the Chairmanship of Shri Asim Barman, Municipal Commissioner, Calcutta Municipal Corporation to look into all aspects of solid waste management in Class-I cities of India. The Committee, in its Final Report submitted in March 1999, made various recommendations for modernisation of solid waste management in Class-I cities, which included:

- Ban on throwing of wastes on the streets.
- Storage of wastes at source.
- Community bins for multi-storied buildings, commercial complexes, group housings and slums.
- Door step segregation and collection of wastes.

- Involvement of NGOs in organising rag pickers.
- Special bins for hazardous and toxic wastes.
- Sweeping of streets and public places on all days of the year.
- Work norms ranging from 250 to 750 running meters of road length per sweeper.
- Provision of litter-bins at public places.
- Abolition of open waste storage sites and unhygienic street bins.
- Transportation of wastes to synchronize with waste storage facility.
- Conversion of organic wastes into fertilizer (compost).
- Adoption of only proven technologies.
- Land to be made available on priority for processing and disposal of wastes.
- Adoption of criteria for landfills.
- Institutional strengthening and capacity building.
- Financial support to urban local bodies by the State and Central Governments.
- Strict enforcement of regulations and norms.
- Adoption of management information system.
- Active involvement of citizens.
- Use of information, education and communication for public awareness.
- Constitution of a Technology Mission for solid waste management.

Taking a cue from the above recommendations, the Government of India notified the draft Municipal Solid Waste Management and Handling Rules, 1999 on 27 September, 1999 inviting suggestions and objections within 60 days. On the basis of the suggestions and objections to be received, the final rules will be notified in due course.

The salient features of the draft Rules are as under:

1. Municipal solid waste be collected, segregated and disposed of by the Municipal Bodies in accordance with the procedure laid down under the Rules.

2. The Rules provide criteria for selection, operation and monitoring of landfill sites to protect the air and ground water from getting polluted.

3. The Rules give standards for composting as well as those for the treated leachates from the landfill sites.

4. The municipal authorities are required to submit comprehensive report on a yearly basis covering all aspects of solid waste management to the Deputy Commissioner/ District Magistrate who will forward the report to the Central Pollution Control Board through the concerned State Pollution Control Board/State Pollution Control Committee.

5. The Rules lay down an implementation schedule for setting up of disposable facilities, including those for composting. The target dates for these facilities depend upon the population of the concerned cities and towns.

Four Workshops were held during October to December 1998 in Calcutta, Chennai, Mumbai and New Delhi. These Workshops discussed various aspects of solid waste management in Class-I cities of India.

Taking into account the fact that bio-medical wastes are quite often dumped in municipal solid waste bins and handled and disposed of along with municipal solid wastes leading to threat to environment and health of the people, comprehensive Bio-Medical Waste (Management and Handling) Rules, 1998 were notified on 20 July, 1998. The Rules provide requisite details about their application, duties of the occupiers, methods for segregation, packaging, transportation, storage, treatment and disposal to be practised. The Rules provide for a Prescribed Authority for every State/Union territory and also give schedule for installation of waste treatment facilities like incinerator/autoclave/microwave system. Also, the Rules give standards for treatment and disposal of bio-medical wastes.

Plastic wastes comprise 5 to 10 per cent of the municipal solid waste. Quite often, thin plastic bags and packaging material are not removed by the rag pickers and waste recyclers leading to littering of the environment. To take care of this and other related issues, the Recycled Plastic Manufacture and Usage Rules, 1999 were notified by the Government of India on 2 September, 1999. These Rules prohibit the use of carry bags or containers made of recycled plastics for storing, packing and carrying of food stuffs. According to these Rules, carry bags made of plastics will not be of less than 20 microns thickness. The Rules further prescribe that virgin plastic carry bags will be in natural shade and or white.

The Indian Center for Plastics in Environment (ICPE) has been established with its headquarter in Mumbai. The purpose of this center is to provide guidance to the plastic industries towards reduction in wastes, better utilisation of wastes and to create facilities for better research in the field of plastics and improved interaction of the plastic industry with the society.

## Hazardous Wastes

Though a major part of the wastes generated are of non-hazardous type, substantial quantities of hazardous wastes are also generated. In spite of various steps taken for management of wastes generated by various sources, only a small proportion of solid wastes is properly utilized and disposed of. As a result, some of these wastes cause environmental degradation and health risks in one way or the other.

The Environment (Protection) Act, 1986 emphasises the need for laying down procedures and safeguards for handling hazardous substances and preventing accidents. Four sets of Rules have also been notified under the Environment (Protection) Act, 1986. These are the Manufacture, Storage and Import of Hazardous Chemical Rules, 1989; the Hazardous Waste (Management and Handling) Rules, 1989; the Manufacture, Use, Import, Export and Storage of Hazardous Micro-organisms/Genetically Engineered Organisms or Cells, Rules, 1989; and the Chemical Accident (Emergencies Planning, Preparedness and Responses) Rules, 1996.

The Hazardous Wastes (Management and Handling) Rules (HW Rules) were notified by the Ministry of Environment and Forests in July, 1989 under the Environment (Protection) Act, 1986. These Rules provide for regulating the generation, collection, storage,

transport, treatment, disposal and import of 18 categories of hazardous wastes. One of the important stipulations made under these Rules is that the import of hazardous wastes from any other country to India is not permitted for dumping and disposal.

India is a party to the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal. The Ministry of Environment and Forests has been designated as the Competent Authority. The Convention seeks to promote the reduction in the generation of waste and calls for international cooperation in development of cleaner technologies.

The wastes from other countries are exported in large quantities for processing, reuse and recovery and to be used as raw material in our industry in accordance with the Hazardous Wastes Rules, 1989. The hazardous wastes are included in the restricted lists of imports requiring a licence, which is granted subject to the recommendation under the HW Rules.

## Radioactive Wastes

India is also concerned with the environmentally sound management of radioactive wastes. The need for the establishment of a nuclear waste management system in the country was recognised at an early stage of India's nuclear programme. The system takes care of all radioactive waste generated from nuclear facilities as well as in the applications of nuclear material in industry, research, medicines, etc.

There is a legal framework for the management of radioactive wastes and an independent regulatory body with the responsibilities for carrying out statutory control with regard to health, safety and environmental protection.

## Toxic Chemicals

Chemicals occupy an important place in the effort to meet the social and economic goals of the community. However, many chemicals are toxic, highly reactive, explosive or flammable, or have a combination of these characteristics and represent a potential risk to human, animal and plant life and the environment in general. Extreme care is necessary while handling such chemicals at all stages of manufacture, processing, transportation or use.

India is a member of the International Programme on Chemical Safety (IPCS) and International Register of Potentially Toxic Chemicals (IRPTC). At the national level, the following efforts are under way:

(i) A Centrally sponsored scheme to create infrastructure in certain regulatory organisations.

(ii) Hazard analysis and off-site emergency plans in sensitive industrial pockets.

(iii) The establishment of emergency response centres.

(iv) Establishment of poison control centres at select places with some available infrastructure. At present, except for a limited number of hospitals, cases of chemical poisoning are treated only in general emergency wards.

(v) The promotion of epidemiological studies in areas of high risk. This involves collection of data from hazardous installations and relating to pollution status, etc.

After the Bhopal disaster of 1984, the Government has taken steps, both regulatory and non-regulatory, to reduce the environmental risk from exposure to chemicals. The Environment (Protection) Act, 1986 lays down procedures and safeguards to regulate the handling of hazardous and toxic chemicals. The Public Liability Insurance Act, 1991 was enacted with the objective to render relief to chemical accident victims. Steps have been taken to phase out Benzidine and Benzidine based dyes and intermediates through this instrument. Analogous provisions exist in the Insecticide Act and the Prevention of Food Adulteration Act.

To limit the discharge of pollutants into water and into the air, standards have been laid down under the relevant Acts. The 'polluter pays' principle has also been adopted. Environmental impact assessment has been made mandatory in the cases of specified projects and the use of less toxic chemicals, insofar as it is feasible, suggested before the sanction of the environmental clearance.

For prevention and control of major chemical hazards, legal safeguards have been framed under the Manufacture, Storage and Import of Hazardous Chemical Rules, 1989. Specific requirements have been prescribed for safe transportation of hazardous chemicals. Exposure limits for chemicals and toxic chemicals have also been laid down. Recently, environmental audit has also been made mandatory,

one of the aims being to reduce environmental risk. Government is also encouraging the use of Clean Production Technologies by providing fiscal benefits. The award of the 'ECOMARK' to consumer products which are environment friendly also encourages the use of safe chemicals and technologies.

## Conclusion

The environmental scene of the country today is of both concern and hope. The concern arises from the various environmental problems/issues which require immediate attention. The hope for environment arises from the fact that our country is still one of the world's richest in terms of biological diversity and other natural resources. The hope for the future is also based on the many positive factors that are emerging — increasing number of peoples' movements focusing on environment, greater public and media concern for these issues and the spread of environmental awareness among children and the youth.

# ENVIRONMENT AND SUSTAINABLE DEVELOPMENT

## SUMMARIES OF COUNTRY REPORTS PRESENTED AT THE SEVENTH APPCED

Being an agro-based country, the solid wastes in Bangladesh are generated mainly from agricultural residues, domestic and municipal sources, trading centres, street sweeping, industrial, commercial construction and farming activities and urban centres.

## Solid Wastes Management in Rural Areas

In rural areas, there does not exist any organized authority for waste collection and disposal in a hygienic manner. The solid wastes/ garbage generated from agriculture and domestic activities every day in every household in the countryside are generally dumped in selected dumping grounds beside the dwelling house to remain there for a long period of time. After that period, the decomposed wastes in the dumping ground form compost which are used by the farmers for soil conditioning purposes and the cycle goes on. Agricultural wastes produced in the form of cowdung, jute stick, rice straw, rice hulls, bagasses, firewood, twigs, leaves and other wastes are reused as fuel by the households in the countryside. Unlike in the countryside, waste management in the cities and towns is more or less organized.

## Solid Wastes Management in different Urban Centres

The quantity of municipal wastes generated in an urban centre in Bangladesh is increasing proportionately with the increase in population; at the same time, the increase in service facilities is lagging behind. As a result, the degradation of the quality of urban environment has become a concern and the importance of efficient municipal wastes management in the urban centres is being increasingly recognized.

The municipal solid wastes in the urban centres of Bangladesh generate mostly from domestic, commercial and industrial sources. The per capita waste collection in Bangladesh for disposal is comparatively far lower than the waste generation rate in several developed countries. The lower rate of waste generation may be due

to the fact that some of the wastes escape municipal collection and are dumped in local low-lying areas. Moreover, extensive recycling of wastes in urban centres has contributed to the reduction in the quantity of wastes for collection and disposal by municipalities.

The major components of municipal solid wastes include food wastes, market wastes, leaves, grass, paper, hoards, glass, textiles, plastics, metals, cans, bricks, debris, dirt and ashes. The very low presence of paper, plastics and metal indicates extensive recycling of these components of the refuse.

## Recycling of Solid Wastes

In Bangladesh, wastes of some market value are being reclaimed or salvaged in three stages. In the first stage, the housewives separate the refuse of higher market value such as papers, bottles, fresh containers, old clothes, shoes, etc. and sell them to street hawkers. The second stage of salvaging is carried out mostly by children of slum dwellers who collect the refuse and commercial wastes of low market value from bins and sweeping accumulation centres. The third stage of salvaging is done by the refuse pickers when fresh refuse is unloaded by municipal trucks at the final disposal site. The reclaimed materials reach the waste and old materials shop through street hawkers who purchase the old materials directly from the households and through refuse collectors who reclaim materials from bins and final disposal sites.

### (i) Waste Paper and Old Clothes

Paper is one of the much used items in our every day life. Inked paper, books, magazines and old newspapers sold by households are used in the first cycle for packing loose materials in retailer shops and in folds of new clothes. These papers are then discarded by households as waste paper. The discarded papers and boards salvaged from the bins are used in the second cycle as raw materials for the manufacture of new boards and are recirculated in the market for various uses.

The old clothes of comparatively good quality are used by the poor people in the first cycle. The rags are used for cleaning purpose in the second cycle and finally these are used as raw material in the manufacture of boards.

### (ii) Plastics and Rubber

Plastic wares, polythene bags and PVC products are now a part of rural and urban lifestyle. The used and old plastic can be easily remoulded to produce new products. The prices of various types of old plastics and rubbers vary with the quality of the materials. The old plastics are converted into powder for moulding of various products in the factory. The quality of plastics deteriorates with age and the number of times these are remoulded for new products. According to an estimate, more than 10 million plastic bags are being salvaged and converted into alternative plastic products. The recovery and recycling of plastics are contributing towards the reduction of anticipated plastics related environmental degradation. It has been estimated that more than 90 per cent of the plastics are being recycled.

### (iii) Glass

Glass is a much recyclable item in Bangladesh with or without remoulding. Some glass containers and bottles are continuously re-circulated and hardly reach the final disposal site. For example, the glass containers of a particular brand reach directly or through intermediate dealers to the appropriate companies for reuse in marketing their products. The circulation goes on until the container is broken and remoulded in a glass factory to make alternative glassware. At present, there are about 34 factories in Bangladesh for making glassware by remoulding broken glass.

## Socio-economic and health impacts of recycling

The waste pickers or scavengers are most notable features of recycling activities in a city. They are extremely poor, uneducated and unaware of any harmful consequences of continuous exposure to contaminated wastes. Some of them pick from litters, bins in streets and parks and collect the materials in gunny bags resting on their back. A large number of waste pickers live around the refuse dumps in apparently insanitary conditions. Ignorance, illiteracy, inability to cooperate among themselves and indebtedness to buyers of recycled material have put the scavengers in a socially weak and disadvantageous situation.

The scavengers and the people working in recycling industries are exposed to contamination and hazardous conditions. The poor people engaged in manual sorting and resource recovery from garbage

become prey to many pathogens and diseases. The scavengers have been found to be suffering from worm infection, skin disease, diarrhoea, chronic dysentery, viral hepatitis, etc. Hazardous emission from melting of plastics and glass cause chronic bronchitis, bronchial asthma and other respiratory diseases. The recycled material, if not treated or processed properly before recycling, may be hazardous to public health in general.

## Final Disposal

The organic decomposable fraction of the municipal waste left after unorganized reclamation of items of immediate market value is disposed off by open dumping in low-lying areas in and around urban centres. The leachate produced by infiltration of rainwater or surface water into a garbage dump has extremely high pollution potential. In general, the composition of leachate is a function of type and age of the waste and prevailing physico-chemical conditions and the microbiology and water balance in the garbage dump.

## Conclusion

The present practice of solid waste collection, recycling and disposal needs improvement in order to reduce adverse impact on community, environment and public health and to maximize resource recovery and utilization. The existing resource recovery and recycling require organizational support with provisions for health protection and health care facilities for thousands of people engaged in these activities. Training should be given for proper reclamation, processing and the best utilization of recyclable and valuable wastes. The organic fraction of solid waste may be separated before land filling and converted into compost for environmental protection and to promote recycling of unutilized resources present in solid wastes.

The management of waste produced in urban areas is one of the major challenges facing Canadians. The quantity of waste generated in this country is substantial: 21 million tonnes of solid waste in 1995, the equivalent of 1.7 kg per person per day. If waste from demolition and construction sites is included, the figure totals 29.3 million tonnes of solid waste in 1992, making Canada one of the largest producers of urban solid waste in the world.

Although the Federal Government has certain powers over the import, export and labelling of packaging, the regulation of waste management falls under provincial jurisdiction. The regulations adopted, whose number, scope and content vary with each province, concern aspects such as the management, recovery, development and elimination of wastes of all kinds, as well as public education and participation research and support for businesses.

## Federal Authority: The National Packaging Protocol and Incineration Guidelines

In Canada, packaging represents one-third of all solid waste generated by municipalities. The Canadian Council of Ministers of the Environment (CCME) has adopted a guide for packaging management, the National Packaging Protocol (NPP, 1990), intended for municipalities and signed by Environment Canada on behalf of the Federal Government. The Protocol's objectives are the reduction of discarded packaging waste through at-source reduction and re-utilization initiatives. The CCME's National Packaging Task Force has also coordinated a number of activities involved in the Protocol's implementation, which have given rise to other tools. Perhaps the most important is the Action Plan of the Federation of Canadian Municipalities (FCM), whose overall objective is to ensure that NAPP policies are complied with and that its objectives are achieved.

The FCM's Packaging Waste Reduction Guide is offered to all Canadian municipalities to help them reduce packaging waste, in particular by adopting effective supply practices. There are many other tools for managing these types of waste, such as the Canadian Code of Preferred Packaging Practices, the Packaging Audit and Packaging Reduction Plan Guidelines, Environmental Profiles, the Guidelines for Achieving the Objectives of the National Packaging Protocol by Business, and the NAPP Bulletin.

In addition to signing the National Packaging Protocol, Environment Canada supports and facilitates other waste reduction activities and monitoring, develops and disseminates information, and supports 3R-technology transfer—reduce, re-use and recycle. The Department provides financial assistance for research and development for new waste management technology and promotes products that have a reduced impact on waste management through environmental certification as part of the Environmental Choice Programme. The "greening" of Federal Government operations has included the establishment of waste reduction and recycling programmes.

At the national level, the CCME Waste Committee in 1989 produced Operating and Emission Guidelines for Municipal Solid Waste Incinerators, designed to help municipalities manage their existing domestic waste incinerators or to build new plants. These guidelines are especially designed for energy produced from waste incinerators fired with municipal solid waste; these offer the opportunity to reduce the amount of material that must ultimately be landfilled while at the same time producing usable energy. The guidelines detail strict procedures and standards for the release of flue gas, ash residues from combustion, emission control processes and, to a lesser extent, processing waste water. They also recognize the important roles that reduction, recovery, recycling and reuse must play in the control and disposal of municipal waste. Furthermore, the guidelines recommended a ban on new small-scale residential, commercial, and institutional incinerators that cannot meet the minimum combustion requirements, and the phasing out of existing systems that do not meet the minimum standards.

## The Three Rs

With the help of provincial, territorial and municipal governments, countless initiatives have been taken for implementing the principles of the three Rs to reduce, reuse and recycle household waste products. Waste was reduced by 23 per cent per capita across Canada between 1988 and 1994 as a result of such programmes. Governments encouraged and promoted waste reduction by passing legislation and regulations, creating and supporting infrastructure and developing educational programmes, all designed to promote use of the 3 Rs in all sectors.

## Selective Collection System

Most major Canadian cities now have a selective collection system for the recovery and re-use of waste matter whereby citizens sort their waste into various categories, such as tin cans, glass bottles and jars, rigid plastic containers, styrofoam containers, aluminium foil, empty paint containers and aerosol cans and milk and soft drink and juice cartons. A number of cities also offer the opportunity to dispose of hazardous domestic materials (batteries, motor oil, paint, pesticides, chemicals, etc.) at a collection centre. As a result of these initiatives, more and more frequently it is only non-toxic wastes that are being disposed of in landfill sites; this prolongs their useful life and reduces any harmful impact on the environment.

## Recycling

The recycling industry has existed in Canada since early in the century, when used rags and cellulose material were even then being used to make paper, and bone meal fertilizer was produced from slaughterhouse carcasses. Similarly, recycled metal has long been used in Canada's industrial processes.

Recycling of household waste started later, however, gaining ground in the mid 1980s. Today, at least 53 per cent of households take advantage of some kind of recycling activity, and more than 2 million of them take part in a municipal programme that includes the collection of recyclable material. These waste material are picked up separately from the non-recyclable waste and taken to a centre where they are sorted, made into bales and sold to the processing industries.

## Composting

Across the country, composting is attracting increased attention as an environmentally sound way to manage yard waste as well as industrial sludge. Composting turns organic waste into a superior soil conditioner or mulch suitable for most landscaping and gardening uses.

In Ontario, for example, composting of leaves and yard waste is mandatory in all municipalities with more than 50,000 residents.

## Deposit-Return

The deposit-return principle involves collecting a deposit, which is refundable in whole or in part, when a product is purchased, to promote post-consumption recovery; as a result, beverage producers have greater responsibility for the containers they use. The funds generated by this type of programme go towards paying for recycling centres which receive operating allowances for collecting beverage containers and in many cases agree to pick up other recyclable material.

## Sanitary Landfill Sites

The concerns of the past few years have led managers to change their procedures for burying waste and new requirements for sanitary landfill have been established across the country. These requirements focus in particular on the collection of leachates so as to protect the immediate environment, the development of watertight sites to protect groundwater, and the collection and safe evacuation of bio-gases. Many existing landfill sites take advantage of the soil's ability to filter out substances and purify leachates. However, sites increasingly have water collection and treatment equipment. Efforts are being made to ensure that sites are developed in accordance with strict rules, far from sources of drinking water and in such a way that they do not pose a threat to everyday life. Waste matter that cannot be reduced at source, recycled or recovered will thus be eliminated in a way that is safer for the environment and for human health.

## Incineration of waste

In view of the increasing cost of landfill operations and site maintenance, the filling up of existing sites, and the high price of land near urban areas, incineration of domestic waste has become an interesting alternative, particularly when used in combination with efficient recycling programmes. Technological improvements, and its potential for producing energy from waste, have also helped promote incineration.

In Canada, the use of incineration for disposing of domestic waste is limited to 8 per cent only. All the currently operating incinerators are highly efficient, whether for burning municipal waste, producing steam delivered to nearby industries or in the production of electricity.

## Integrated Solid Waste Management in Urban Centres

In Canada, government authorities have made a considerable effort to reduce, reuse and recycle the solid waste produced in urban centres. The phenomenal growth of household and industrial recycling and composting over the past 15 years has decreased the volume of waste going to landfills and incinerators. The highest rate of recovery is for metals, paper, cardboard and glass, but other materials, particularly the various types of plastic, are increasingly being collected by recycling firms. Significant progress has also been made with regard to construction and demolition waste. Furthermore, breakthroughs in technology mean that it is now possible to mitigate the environmental impact of burying or incinerating solid waste. Incorporating the views of the public more fully may make these options more socially acceptable.

The progress made at all levels in waste management in recent years demonstrates the importance of adopting an integrated vision and planning process for solid waste management. Integrated waste management involves considering all the sources of waste material—domestic, industrial, commercial or institutional. All those involved, including the general public, must be closely involved in the development of waste management plans to ensure that they are comprehensive and adhere to the approaches, objectives and methods identified for recovering as much as possible of the waste generated in the area.

# FEDERATED STATES OF MICRONESIA

The Federated States of Micronesia (FSM) is a nation of about 105,000 people inhabiting many small islands in the Central Pacific. The ocean area is very large, but the land area is quite small. It has a population density of about one hundred fifty persons per square kilometre.

Over the years, the population increase has contributed to increases in waste generation. These increases combined with the changing consumption patterns over the last decade have magnified the environmental problem of waste and trash. The increasing use of imported packaged foods alone results in the generation of significantly more trash. Add to that, everything from disposable baby diapers and motor oil to refrigerators and cars, all of which, must be disposed of. As such, FSM faces a significant waste disposal problem given the limited land area and the fragility of environment.

Traditionally, most of what was used was simple and biodegradable. Since FSM started importing packaged and disposable things, most of which do not degrade in an environment friendly manner, people have come to realize that what they do to their environment can hurt them, their children, and their grandchildren in the long run.

Once attitudes begin to change, there is a need to be organized to generate and sustain the necessary energy and commitment to improve the means of dealing with domestic wastes. The organization process can begin with an important event. In Kosrae, the hosting of the Second FSM Games, a national sports event, was used as a reason for organizing a clean-up. This clean-up coincided with a move of a landfill to a more appropriate place and the institution of trash separation procedures designed to reduce negative effects.

The activities of non-governmental organizations have been very helpful in the organization process. But, there are many problems that cannot be dealt with by motivated, organized people alone. Sometimes the lack of money and technology is an obstacle. Given the lack of funding and access to technology, the FSM would continue to seek some foreign assistance in this area.

Meanwhile, the Government must consider environmental taxes or fees to discourage the import of difficult-to-dispose-of products. If revenue from these same taxes or fees can be put to use funding environmental clean-up, they will serve a dual purpose.

At present, the Islamic Consultative Assembly of Iran is deliberating the Third Five Years Economic, Social and Cultural Development Plan.

Of the 26 chapters of the above-mentioned Plan, the chapter of environmental policies has been given far too importance.

To protect the environment and to optimize natural resources of the country, aimed at the accomplishment of the objective of sustained development, the Islamic Consultative Assembly has mandated the Government to undertake the following actions:

(i) Preservation and protection of basic and genetic resources;

(ii) Basic resources' integrated management;

(iii) Institutionalization of public participation in planning, decision-making and implementation, targeted at a balanced protection of the ecosystem; and

(iv) Promotion of public participation for achieving the aforementioned objectives, and working out persuasive and deterrent policies.

To carry out waste treatment, garbage disposal and reduce air pollution in metropolitan cities, the Government of the Islamic Republic of Iran is guided by the standards adopted by the World Health Organization.

One of the main objectives of environmental policies provided for in the Third Development Plan of the country is to establish well-defined limits for prevention of pollution and destruction of natural resources in the Caspian Sea, as well as the implementation of an integrated coastal management scheme.

The Lao PDR's economy is virtually undiversified and depends largely on the country's natural resource base. The country is endowed with abundant natural resources, like forests, biological diversity, water, minerals and land. While the country's rich forestry resources have already been largely exploited, mineral, biological diversity, and water resources remain almost untouched. Ecosystems are still quite intact due to the low population density and the difficult terrain.

The aim of the Lao Government is to undertake national socio-economic development with minimal impact on the environment, with sustainable use of the national natural resources, even while preserving its customs and traditions. It has been reflected in all the National Socio-Economic Plans, in the Constitution, in the legislations, in the National Environment Action Plan as well as in the National Priority Programmes.

The Government recognizes the need to strengthen the established institution in charge of overall environment management and the necessity to define a legal and regulatory framework and procedures across sectors which would ensure that environment concerns become an integral part of the developmental planning.

## Environmental issues in the Lao PDR

The main environmental problem in the Lao PDR is deforestation, especially the degradation of forest resources from year to year. The reduction of forest resources is averaging 300,000 ha per year.

The causes of the deforestation are slash and burn cultivation, illegal logging, encroachment of farmers into forest areas by expanding agricultural land, forest fire and unsustainable rate of annual timber extraction.

Resultantly, the environmental consequences from deforestation lead to degradation of watershed areas, increase in sedimentation, soil erosion, natural disasters such as floods, droughts, landslides and air pollution. Besides deforestation, there are other environmental issues originating from industrial, mining and transport development.

The Government recognizes the need to establish an adequate institutional structure in charge of the overall environmental management and the need to define legal and regulatory framework and procedures across sectors, which ensure that environmental concerns become an integral part of development planning. More recently, urban development is the subject of increasing concern. Existing water supply systems in different towns are generally in poor conditions. Ground water contamination, both from industrial and domestic wastes, is slowly becoming a serious issue in the capital and in other cities.

## Environmental Management and Protection in the Lao PDR

Before the year 1993, the Lao PDR did not have any particular agency, responsible for overall environmental management and protection. Environmental issues were managed by the various Government Ministries/sectors according to their responsibilities.

In 1993, the Lao Government set up the Science, Technology and Environment Agency (STEA). STEA is a Government agency and is under the Prime Minister's Office. STEA is responsible for overall environment management throughout the country and it is a main coordinator for environmental management and protection.

To ensure effective environmental management and protection, STEA has established an inter-Ministerial Working Group on Environment (IMWGE). This Group consists of representatives from the line Ministries concerned, such as the Ministry of Public Health, Ministry of Agriculture and Forestry, Ministry of Industry and Handicrafts and so on. IMWGE helps STEA review and evaluate environmental impact assessment reports of major proposed development projects.

Bearing in mind the importance of environmental protection in general and waste treatment and garbage disposal in particular, the Lao Government has paid special attention to sustainable development strategies such as integrated rural development plan, termination of slash and burn cultivation project, afforestation and forest conservation projects, embankment and so on.

In conjunction with the efforts made to keep balance between socio-economic development and environmental protection, the National Assembly has enacted a number of laws. In the 1991 Constitution, article 17 stipulates that all organizations and citizens

must protect the environment and natural resources: land, forests, fauna, water sources and atmosphere. More recently, Lao PDR has promulgated a series of laws contributing directly and indirectly to the protection of environment such as the laws on water and water resources, land, natural resources, mining, electricity, urbanization and others. All laws on socio-economic development have special provisions dealing with waste treatment and garbage disposal. In March 1999, the Lao PDR National Assembly approved the law on environmental protection. Apart from general provisions on environmental protection, the law also deals specifically with waste treatment and garbage disposal. The law defines in detail waste pollution, soil pollution, air pollution, toxic chemical pollution, radioactive pollution and pollution arising from disturbing vibration, sound, light, color and smells. The law further provides that individuals and organizations are obliged to participate in pollution control and businesses that undertake activities that create pollution must use pollution control equipment in accordance with the prescribed environmental quality standard.

The law also requires manufacturing businesses to use advanced technology which is suitable to the actual socio-economic circumstances, to minimize the environmental impact. Individuals and organizations are obligated to diligently take part in the rehabilitation of the environment.

The very first solid garbage disposal project in the capital city Vientiane started 7 years ago with financial assistance from Japan. At the first stage, the project focused on locating waste dumping sites, the creation of "Clean Vientiane Campaign", the introduction of relevant technology for waste treatment and the reusing and recycling of wastes.

However, the project still has a long way to go. The following points need special attention: large portion of waste is not routinely collected; collection of vehicle fleet is old and subject to frequent breakdowns; crude open dumping is adopted at the present disposal site, causing environmental problems; and financial and auditing procedures are in need of revision.

# MEXICO

In Mexico, the handling of solid municipal residuals, as a public service, is a function of the State and Municipal Authorities. The States, through their Legislatures, legislate in this matter while the Municipalities frame regulations and have administrative institutions that take charge directly of the public service consistent in gathering, sweeping of streets, transport of residuals and final disposal.

In an effort to promote environmental protection and to improve the quality of life of the Mexicans, the General Law for Ecological Balance and Environmental Protection was approved by the Parliament in 1988. The last, reformed in December of 1996, recognises the role of States and Municipalities in order to regulate the handling of solid wastes and additionally authorises the Federal Government to elaborate official norms to structure the public service.

Considering that the only way of achieving a sustainable handling of the residuals is through the participation of governments and other sectors, Mexico has adopted a legal framework that emphasises a full co-ordination in order to achieve this objective. It is also necessary to highlight the importance of involving the society in the establishment of these norms in order to reaffirm its responsibility. With educational campaigns that show the problems of an inadequate handling of solid residuals in the areas of health, ecology and urban development, one could promote civic conscience. Besides legislative reforms and promotion of civic participation, a fundamental aspect in order to achieve the sustainable handling of solid residuals is technology.

The environmental policies in Mexico regarding residuals include the following alternatives:

(i) Reduction of generation—This strategy is a governmental priority and should be carried out in an institutional, industrial and domestic level, improving the habits of purchase and recycle of products and acquired material. This aims at going to the root of the problem, through inducing the design of products and containers with a minimum of toxic materials.

(ii) Recycle—Recycle is an option that allows the enlargement of a product cycle life as well as the space in the sanitary fillings, saving energy and natural resources, as well as taking advantage of the value of certain residuals generating economic benefits.

(iii) Thermal destruction with recovery of energy—Incineration contributes to the reduction of the volume of the residuals, besides offering the additional benefit of generating energy.

(iv) Final disposition in sanitary fillings—Sanitary fillings are located in appropriate places and are designed, built and operated in appropriate form. They constitute an alternative for the final disposition of those solid residuals that are not recyclable.

Therefore, it is required that the technologies implemented assist the most urgent necessities, and reduce the costs of operation as well as the environmental impacts of the handling of solid residuals. Due to the high costs of these operations, it is necessary to foresee outlines of investment and of appropriate administration for an integral environmental policy that establishes priorities and promotes the sustainable use of the resources, as well as saving of energy, water and material in the processes of transformation.

## Steps taken for sustainable handling of residuals

As part of the strategy to achieve the invigoration of the capacity of administration of solid residuals in Mexico and the establishment of State Programmes of Minimisation and Integral Handling of the Dangerous Residuals, technical offices have been created in each federative entity as part of the Mexican Net of Environmental Disposal of the Solid Residuals (Remexmar).

The Remexmar is a non-governmental net that is part of the Pan-American Net of Environmental Handling of Residuals (Repamar), of which Mexico, Argentina, Brazil, Colombia, Costa Rica, Ecuador, Peru and Paraguay are members. This Net is conformed by the representatives of Governmental dependencies, academic institutions, industrial associations, professional associations and groups of social interest that aim to establish a programme of integral handling of the residuals.

Another initiative taken to promote sustainable development is the creation of the Group "Integral Handling of Solid Residuals" founded on the initiative of non-Governmental organisations. For several years, this Group has been promoting the reduction of the generation of solid municipal residuals, developing didactic material and imparting courses of training. The activities of this Group contribute to the design of policies and programmes to solve the problem.

The problems of the handling of the solid residuals are, therefore, extremely complex and require civic participation, legislative reforms, application of appropriate technologies and financial self-sufficiency of the service for which it is necessary to have an integral plan of handling, technical projects and reception of funds for the required investment.

In Mexico, the objectives of achieving a sustainable development in the matter have been expounded, and certain lines of work have been traced. However, there are many areas where the participation and experience of all the actors of the international system have to be ensured in order to achieve an integral solution.

The responsibility for managing waste disposal in New Zealand is largely in the hands of local authorities who manage landfills, refuse collections, sewerage and storm water systems, air pollution discharges, and the clean-up of contaminated sites. Sometimes, these tasks are undertaken directly by the authorities and sometimes they are contracted out to private operators.

Territorial local authorities have a statutory responsibility under the Local Government Act 0641 for ensuring that waste collection services are provided. In 1996, the Local Government Act was amended to require that every territorial authority adopt a waste management plan incorporating the waste management hierarchy. There is, however, no statutory standard for the plans.

Waste disposal practices are governed by the Resource Management Act, 1991. This aims at promoting the sustainable management of natural and physical resources, and controlling environmental discharges. This Act is effects-based, and individual councils are responsible for setting standards for treatment plants.

The Government's 1992 Waste Policy has two aims:

- to ensure that as far as possible, waste generators meet the cost of managing the waste they produce; and
- to encourage the implementation of the waste hierarchy of reduction, reuse, recycling, recovery and residual management by waste producers.

At the national level, the Government has promoted its policy through a mix of strategies, including voluntary agreements and promotion of cleaner production and support of the eco-label, and environmental choice. Voluntary agreements have been made with the packaging industry to reduce unnecessary packaging waste, and with the major oil companies to cover the recovery of used oil. The Sustainable Management Fund exists to provide support for a wide range of environmental initiatives. Some of those relating to waste

include cleaner production programmes for industry, retailers, orchardists, and hospitals, agrochemical and hazardous substances collections, waste analysis programmes and waste management guidelines.

The Ministry has provided Cleaner Production and Landfill Management and Monitoring Guidelines as a means of encouraging good practice. Landfill practice is being reviewed, and regulations covering some aspects of landfill practice are likely to be developed under the Resource Management Act.

New Zealand is an active and committed party to the Basel Convention on the trans-frontier shipment of hazardous wastes. Accordingly, a policy framework for the management of hazardous waste is under development. This will address the full range of activities from prevention and reduction through to safe disposal.

## Solid waste disposal

Though most of the medical and quarantine wastes are incinerated, New Zealand does not use incineration for disposal of ordinary solid waste. Another form of incineration is provided by the cement industry which burns used oil in high temperature furnaces at one south island site. Used oil is also burnt in other high temperature applications, as well as in some low temperature applications such as heating glasshouses. In addition to landfills, New Zealand disposes of a large amount of construction and demolition wastes into cleantills, which are only allowed to accept inert, non-hazardous wastes.

The harnessing of landfill gas for electricity generation is a growing industry in New Zealand. While a number of landfills flare the gas, several are now using the gas, principally for heating. In Wellington, over 6 per cent of the natural gas used is from landfills.

It is estimated that 80 per cent of the population has access to one or more recycling schemes for paper, aluminium or glass. One of the difficulties with recycling in New Zealand is that transportation of material to markets is very costly. Only a limited number of products like glass, paper, cardboard, aluminium, steel, plastic films, etc. are being recycled.

Of late, an increasing number of local authorities have invested in community composting operations, usually located at transfer stations or landfills. There are a number of commercial operations which process garden waste, as well as a worm composting company which is concentrating on processing organic wastes from the agricultural and food processing sectors. The Living Earth Joint Venture Company has recently started composting biosolids from the new Wellington wastewater treatment plant with greenwaste. The resulting product will be sold as a garden compost.

The scale of hazardous waste generation in New Zealand is only beginning to be understood. The past disposal and careless handling of hazardous waste have left a residual problem of potentially contaminated sites in many parts of the country. The sites are now being investigated and, where necessary, cleaned up by Central and local governments. The Resource Management Act and the Hazardous Substances and New Organisms Act, 1996 were developed to help prevent future occurrences of an adverse nature.

China has always accorded priority for environmental protection in the urban districts. The urbanization process in China has been accelerated since the reforms and opening to the outside world. In 1980, there were 115 cities with a population above 2 lakhs which increasd to 286 in 1998. Urbanization level has also increased from 19.39 per cent in 1980 to 30.4 per cent in 1998. Consequently, cities had to put up with a sharp increase in the number of urban inhabitants, which was followed by the degradation of urban environment.

With economic growth and population increase, the volume of municipal refuse increased at the rate of 9 per cent per year. In order to address the situation created by the increasing municipal wastes, the Government has organized relevant Departments, enterprises, research institutions and experts to be actively involved in the exploration of means and measures from points of volume reduction, resources and harmlessness. As a result, pragmatic and feasible policies on the handling and harnessing of the wastes have been developed. Three treatment approaches, namely land-burying, compost and incineration, have been adopted selectively by each city according to its own economic strength, land resources and waste quality, among which sanitary filling is more often used. Over 510 cities have been involved in a nation-wide environmental protection programme in terms of comprehensive control and quantitative examination. Finally, 11 cities emerged as "Model City for Environment Protection". This programme has facilitated the process of environmental protection.

However, China today is still facing tough challenges in the field of environmental control. Many areas see no improvement yet in the field of environment, some are even worse with problems like soil erosion, deterioration of forest and grasslands, etc. The urban environment, with conspicuous problems such as municipal waste hills, white pollution, water, air and sonic environment pollution, etc., is heavily stressed because of the increasingly growing population and automobiles.

Massive populations, relative shortage of resources, as well as degradation of environment are the critical restraints of the national economic growth and social development. The better harmony of economic and social development with population, resources and environment is a must for the realization of sustainable development. In March 1996, the National People's Congress of the People's Republic of China passed the 9th Five-Year Plan and 2010 Programme Outlook for the National Economic and Social Development of the People's Republic of China to coordinate the concurrent development of social economy with population, resources and environment. In line with the Programme, the country will not only maintain steady growth of economy in the early decade of next century, but also define the following goals:—

(i) By year 2000, to try utmost to bring environmental pollution and ecological deterioration under control and improve the environment of some cities and regions to a certain extent; and

(ii) By year 2010, to basically reverse the situation of ecological and environmental deterioration and make remarkable improvement of the urban environment.

Therefore, China is actively implementing the strategy of revitalizing the nation by science and technology and facilitating the development of the economy and environment control by technical advances and renovations. More technical inputs will be added for environmental preservation by focusing on research and development of advance and appropriate technology. Environmental protection will be gradually shifted from the end control up to the whole process control by a wider application of energy conservation and loss-reduction technology as well as clean production technology, etc.

With implementation of the sustainable development strategy in China, the development of energies such as power, oil and gas, coal bed methane and other new energies are now on the top agenda of the national programme. The treatment of waste water, prevention of air pollution and planting of trees and grass have aroused the attention of the Government of China.

To ensure the smooth implementation of the sustainable development strategy, China pays high attention to the development of legal systems. Various laws with regard to environment protection and resources have been issued. A legal environmental framework has initially come into being on the basis of the Constitution of the People's Republic of China and the Environmental Protection Law of the People's Republic of China as the mainstay, which attempts to contain pollution, improve the environment and lay a legislative foundation. Currently, the National People's Congress is formulating the Environmental Impact Assessment Law. Environmental protection shall be taken into consideration in all major state investment projects, including river basin development, regional development and urban construction, etc. Moreover, certain numbers of laws promulgated in the 1970s and the 1980s got amended and modified so as to fit the new requirement and make the legislative systems more effective.

The realization of the goal of environmental protection must rely on the support and involvement of the public, enterprises and social communities. Therefore, China is always persisting in the promotion and education of environmental protection to the public, popularisation of relevant knowledge, policies and laws on environment and ecological construction so as to make the public bear in mind a good sense and moral concept of environmental protection.

Sanitary landfill is a method of garbage disposal to protect the environment and is used in land reforming which is quite useful in the Asian countries. Sanitary landfill helps in retaining the original level of the land *via* the filling of artificial pits and also improves its use in future in agricultural and industrial developments.

The sanitary landfill must not be randomly chosen. It is important to choose the places which require simplified controlled engineering methods to avoid any danger to environment. It must be carried out in layers not exceeding a depth of two meters which then are buried by soil (25 cm) the same day the wastes are put in the pits. The burial process prevents the reproduction of insects and the spread of the bad smell and the destruction of fly larvae and the pathogenic germs due to the heat generated from the organic decomposition of the burnt materials. The process of sanitary landfill leads to the decomposition of the burnt material, specially if it was well covered, and will lead to the preparation of colloidal material called enzymes which decompose the fixed compounds.

The total amount of the Republic of Korea's waste generation had been dropping gradually until 1993, when it began to increase again. With 1993 as a turning point, the volume of industrial waste generated began to exceed the volume of municipal waste generated.

## Municipal Waste

A notable trend of municipal waste generated is that the percentage of combustible waste is on the rise. The change in composition can be explained by the fact that plastic packaging waste and paper waste increased due to a rise in consumption in proportion to a rise in income levels, while non-combustible wastes such as coal briquette ash decreased.

## General Industrial Waste

Although the percentage of combustible wastes of general industrial wastes is on a steady increase, non-combustible wastes still accounted for 70.2 per cent of the nation's total general industrial wastes generated in 1998. Such a high percentage was due to the fact that general industrial wastes consisted of slag, ash, dust, and construction wastes.

## Waste Treatment

The quantum of waste dumped into landfills is dropping drastically; conversely, an increasing volume is being recycled. The percentage of the volume of waste incinerated is also on a steady rise.

## Waste Management System and Policy Direction

The collection, transportation, and treatment of municipal wastes are the responsibilities of municipalities. The Government formulates basic policy directions for overall waste management, and provides financial support to local Governments. The city Mayors and Provincial Governors are responsible for providing financial support to and coordination between lower level local Governments under their jurisdiction.

The priorities of waste management are, in order of importance, reduction in the volumes of wastes generated; recycling and reutilization; recovery as energy resources; incineration; and dumping into landfills. The first three are referred to as 'minimization efforts'. Under the basic principle of minimization, industrial waste minimization systems and product charges to increase environmental consideration of products are applied during the production stages. During the distribution stage, various measures for restriction on excessive packaging, encouragement of production of refillable and reusable packages and containers, and reduction in packaging material are being taken. At the consumption stage, the Volume-based Collection Fee System for Municipal Wastes and other measures discourage the use of disposable goods. The Deposit-refund System applies to packaging containers, lubricating oils and household electric applicances. According to this system, the producers of these products are held responsible for retrieving and recycling. During the waste treatment stage, the Government applies standards which have been established for storage and transportation of wastes, and operation and management of waste treatment facilities.

## Waste Management System

The Government has enacted several laws to ensure effective waste management. The Waste Management Act provides for matters pertaining to the responsibilities of waste management, waste management planning, standards for waste management, and the waste treatment business. The Act relating to Promotion of Resource Saving and Reutilization deals with matters regarding basic plans for recycling of resources, the deposit-refund system, and packaging of waste management. The Act for Promotion of Waste Treatment Facilities and Support for Local Communities provides for matters regarding the procedures to select sites of waste treatment facilities, and environmental study on, and support for the local communities in the vicinity of waste treatment facilities. The Act relating to Transboundary Movement of Wastes and their Disposal is about matters stated in the Basel Convention, which is designed to control environmental pollution entailing the import and export of wastes.

In 1996, the Government established the Comprehensive Waste Management Plan for the systematic management of wastes. The Plan is a revision of the Comprehensive Waste Treatment Plan (1993-2001) formulated in 1993. This Plan was revised due to more recent changes and implementation of more recent Plans such as the implementation of the Volume-based Collection Fee System for Municipal Wastes (1995) and the system for local government autonomy.

## Policy Direction

The Government plans to formulate policy for waste management under the following basic principles:

(i) Efforts will be made to attain policy goals efficiently by rationally assigning roles and responsibilities to members of the community. In particular, for product wastes, the principle under which the manufacturer, consumer, Central Government, and local governments will share responsibility will be respected and the responsibilities for waste management will be established accordingly;

(ii) In order of importance, the priorities of waste management will be placed on prevention or reduction of the volumes of waste generated, reuse, recycling, energy resource recovery, incineration, and landfill in waste management;

(iii) Measures to attain policy goals will be improved step by step with the intention of realizing both environmental benefits and economic efficiency;

(iv) To increase the opportunities for the private sector to engage in waste management, thereby accelerating the efficiency gains in waste management, the development of viable treatment technologies, and the accumulation of know-how in waste management; and

(v) The environmental information management system will be made public, and opportunities for the general public to voice its opinions will be extended to ensure that major policy decisions are made, based on scientific and appropriate information.

## Waste Minimization

The concept of waste minimization engenders reduction in the volumes of waste generated, reutilization of waste, and use of waste as forms of energy. The Republic of Korea's waste minimization policy can be seen in each of the following stages:

(1) Waste minimization during production stage through the mechanism of system for waste minimization at production sites and product charge system.

Under the system for production site minimization, companies are required to reduce wastes by improving the production processes and recycling. The purpose of the product charge system is to make manufacturers consider the full environmental impact of their products at the production stage.

(2) Waste minimization during the distribution stage by packaging regulation policy.

Under article 15 of the Act relating to Promotion of Resource Saving and Reutilization, and the Packaging Method and Packaging Materials Regulations, restrictions are placed on excessive packaging and on the use of PVC, the production of refillable products is encouraged, and the generation of packaging waste is minimized. Recycling is managed through the Deposit-refund System.

In August 1995, the Directives to Reduce Synthetic Resin Materials for Packaging of Household Electric Appliances, which included annual goals to reduce synthetic resin packaging materials for the protection of household electric appliances, were announced by public notification. The Directives on Annual Reduction of Synthetic Resin Packaging Materials were announced by public notice in July 1996. The directives set forth the packaging reduction or recycling quotas for business establishments that manufacture or import such products.

(3) Waste minimization at the consumption stage through the Volume-based Collection Fee System for Municipal Wastes and Regulations on the Use of Disposable Goods.

The objective of the Volume-based Collection Fee System for Municipal Wastes is to minimize the generation of wastes and encourage households to separate their wastes for recycling. The system was put into effect on 1 January 1995 and strongly adheres to the 'polluter pays' principle.

The Regulations on the Use of Disposable Goods were introduced as a means to reduce wastes at the consumption stage. The system for restraining the use of disposable goods was amended in February 1999.

(4) Recycling of wastes is promoted through various mechanisms like separate collection of recyclable goods, deposit-refund system, fostering recycling industry and expansion of public recycling system.

(5) Recently the following measures were taken to solve the problems associated with wastes:

(i) Treatment Guarantee System for wastes neglected by waste disposal businesspeople

In order to guarantee the treatment of wastes neglected by waste disposal businesspeople, the amendments to the Waste Management Act require that businesspeople choose one of the three following methods, failing which their permits may be cancelled:

- That they form a Mutual-Aid Association to finance the treatment expenses for members who are unable to dispose of waste properly.
- That they sign an insurance policy with an insurer guaranteeing the treatment of neglected wastes.
- That they make a treatment security deposit in advance in the amount necessary to treat the neglected waste.

(ii) Stronger Management of Infectious Wastes

There has long been concern that inadequately treated infectious wastes could damage citizens' health and the environment. In the past, however, infectious wastes were managed separately by the Medical Service Act or the Waste Management Act, depending on the source.

As standards for establishing infectious waste treatment facilities, licensing treatment businesses and punishment are weaker in the Medical Service Act than in the Waste Management Act, there were concerns about inadequate treatment. However, following the unification of infectious waste management under the Ministry of Environment, management standards are to be strengthened from August 2000.

(iii) Measures to secure transparency for compliance regulation in the disposal of specified wastes

When discharging specified wastes for the first time, to confirm the route of the wastes' disposal, the discharger shall submit to the Minister of Environment a disposal plan, the results of an analysis of the wastes, and confirmation of a disposal contract issued by a contractor.

Whenever contracting out the disposal of specified wastes, the discharger shall fill out six vouchers to verify the transfer of the wastes between two parties and submit two of them to the Minister of Environment. Dischargers of small amounts of specified wastes shall fill out four vouchers, which shall be kept by the dischargers and contractors who collect, transport and dispose of the wastes.

At the end of each calendar year, the dischargers of the specified wastes shall submit to the Minister of Environment a yearly report on each waste's classification, amount, and disposal method.

If any waste transporter or disposing contractor or discharger violates regulations for the first time, they shall thereafter obtain approval in advance from the supervising authority whenever transporting or disposing of wastes. If they commit an additional violation, supervisors appointed by the Government shall be stationed to watch the actual conditions of the waste disposal.

(iv) Stricter Punishment Regulations to enhance the Compliance of the Law

If a business illegally dumped wastes or disposed of them in an unlicensed landfill, the punishment is imprisonment of up to seven years and/or a fine of up to fifty million won (about $41,650).

Similarly, if a business infringed on the treatment standards of a licensed landfill, the punishment is imprisonment of up to three years and/or a fine of up to twenty million won (about $16,660).

# REPUBLIC OF PALAU

Palau is a small island nation, with a population of under 20,000 people and a land mass of approximately 200 square miles and the issue of sustainable development is absolutely critical to the well-being of the Palauan people. The Government of Palau's intentions with respect to sustainable development are set forth in two complementary Plans. The first is called the "Palau National Master Development Plan." This Master Plan provides both the operational guidelines for the immediate future of Palau and seeks to set forth a suitable strategy for the pursuit of economic, physical and social development of the country. Key components of this Plan include the protection of Palau's unique marine environment — which is the major attraction for tourists and historically has provided the means of subsistence for most Palauan families — and the inclusion of local people in development projects that are within their financial and management capabilities. The Master Plan, developed originally in 1996 by international consultants with the assistance of the United Nations Development Programme and the United States Department of Interior, has been formally adopted by the Palau National Congress.

The second component of Palau's sustainable development strategy is set forth in the "Palau Sustainable Development Policies and Action Plan." This Plan, originally developed in mid-1997, focuses on tourism trends within Palau and establishes sustainable tourism policies and action plans. An important facet of the sustainable tourism plan, and one which is important for all countries now addressing the need for sustainable development, is the need to develop a framework for re-evaluating governmental policy over time with the constant goal of protecting Palau's unique environment and culture. The Palau National Congress has also endorsed the sustainable development plan as the official policy of the national government.

Having charted its course for sustainable development, the Palau Government now faces the responsibility of putting the master plan and sustainable development plan into action. The Government is attempting to stimulate local participation in sustainable development projects by making capital available to local entrepreneurs through the Palau National Development Bank. The Palau Government also has increased funding for the Environmental Quality Protection Board, the agency charged with permitting and monitoring development projects and enforcing environmental laws. The Government is considering ponding systems to treat sewage and also other "green technologies" that may be appropriate for a Pacific island such as Palau. Another project that the Palau Government currently faces is the urgent need to close the single existing landfill, which is at near capacity and is too close to the lagoon. The Government is studying other potential sites for solid waste disposal.

# REPUBLIC OF PERU

In 1990, Peru initiated a process of State modernization. In the scheme of the growing globalization and the higher competitiveness of national and international markets, the management of solid residues acquires special importance for its sanitary, environmental and economic implications, and more for the preponderance that the principle of sustained development has acquired by virtue of which economic growth has to be compatible with social equity and environmental protection. In this respect, the Government adopted many of the strategies that were defined in "Agenda 21" of the United Nations Conference on Environment and Development.

There are many aspects linked to development that contribute to sharpen the complexity of handling solid residues in Peru. The growth of the Gross Domestic Product — GDP (7 per cent in 1996 and 7.4 per cent in 1997), the opening and modernizing of the national market and the population growth (24 million 371 thousand inhabitants in 1997, with an average growth rate of 1.7 per cent) have initiated a greater generation of solid residues, an increment of its dangerous characteristics and negative impact, generating significant risks for the natural resources and environment quality. Another factor that complicates the handling of solid residues is the process of urbanization.

The generation of solid residues and its handling are linked to development. It is necessary to harmonize the economic activities of the country with proper environmental protection and fundamentally with people's health to contribute with its full personal and social development. As a consequence, the handling of solid residues is included in the regulations associated to the right for an adequate environment and health; and therefore, it has to be an object of an integral legal treatment.

At present, the services for public cleaning and handling of solid residues in general are not enough to cover in a satisfactory way the demands of the population and productive sectors. There is some serious deficiency in the different steps of solid residues handling, from its generation until the final disposal, especially in relation to residues of dangerous nature.

Peru, through its government institutions, municipalities, non-governmental organizations, universities, other institutions and society as a whole, has established a process for the implementation of policies, plans, strategies and technical operating aspects and the required legal frame work, to organize and integrate the handling of the different types of solid residues, on the basis of identification and management of solid residues from their generation sources.

For an adequate management of solid residues, a management capacity strengthening programme in the municipal government field and the implementation of sanitary infrastructures of final dispositions were initiated five years ago. In regard to industrial residues of dangerous nature and those that are objects of frontier movement, regulations in the framework of the Basel Convention have been established, which, through the health sector, has been taking the technical administrative handling.

On the other hand, the National Environment Council (CONAM) develops residue management activities, mainly with the assistance of the United States Agency for International Development (USAID), through which it searches to reduce the generation of residues and to reduce the negative impacts of the inadequate handling of residues. It is almost impossible to eliminate the generation of residue. Nonetheless, it is feasible to control the different stages of the residue handling (generation, segregation, recycling, treatment, transportation and final disposition) and to be able to control the risks of generating negative impacts for the environment and health.

## Environmental management and competitiveness

In the context of reduction of residue generation, CONAM develops the following activities:—

(i) ISO 14000 (adoption of ISO 14000 norms as Peruvian Technical Norms, installation of Environmental Management Systems in businesses and formation of environmental auditors).

(ii) Fostering of clean technology (support to environmental adaptation of the industrial and fisheries sectors).

(iii) Clean Production Centre (promotion mechanism of the clean production concept).

All these activities have as main conceptual base, prevention, that consists in anticipating the environmental impacts of the productive activities and to design mechanisms to control them.

**Residue Management**

In the frame of impact reduction, the CONAM develops:—

(i) Recycling of paper and cartons in school (consciousness and environment culture formation, including homes);

(ii) Recycling of construction residue (Peruvian technical norms to promote recycling);

(iii) Residue Bag (trade exchange mechanism of industrial sector residues, presently under design); and

(iv) National Programme of Residue Management (spread of non-conventional systems of residue management, oriented to medium and small populations).

These activities have as common denominator the risk minimization of environmental impacts derived from the inadequate handling of residues.

## Treatment and Reuse of Solid Residues: A feasible alternative

The best way to tackle the problem of solid residues consists in giving a preventive focus oriented to the modification of customs, production and consumption modalities. The plans of reducing waste to a minimum, reuse and recycling constitute important and urgent programmes to implement.

The collection, distribution and disposal systems have to be organized in an efficient way, the same as the segregation process and sale of waste. Toxic residues disposal deserves special attention as that at present constitutes a latent danger for the whole population.

The legal framework for the management of solid residues has to be clear and integrated and it has to allow the articulation of strategies, plans and programmable actions in the different levels of Government and in the operators' field.

The central norm for the handling of solid residues in Peru is the Urban Cleanliness Regulation which extends only to household and commercial residues and contains some rules for the handling of hospital residues. The national legislation does not establish clear guidelines that facilitate an integral management of residues, nor delimits the attributions of competent authorities, having frequent competition conflicts in the normative aspects of control and sanction.

In order to establish a regulatory framework, the Congress of the Republic has been conducting the process of formulation of the General Law of Solid Residues, through the Environment, Ecology and Amazonic Commission.

Some of the proposals are as under:—

(i) arrange the institutional framework of the management of solid residues through the establishment of responsibilities and clear competitions in relation to normative, regulatory and control functions;

(ii) preserve life quality and health condition of persons exposed to contamination;

(iii) generate healthy surroundings to promote sustained human development;

(iv) establish principles, guidelines and rules for the integral handling of different types of solid wastes, considering all its handling stages, from generation until final disposal;

(v) guide the management of solid residues towards the consolidation of minimization and prevention strategies of the negative environmental impacts;

(vi) promote the participation of the private sector and the civil society in the improvement of the handling of solid residues;

(vii) promote the reduction of wrapping and packing of traded products, especially those of dangerous nature; and

(viii) eliminate centres of rodent and vector burrows that generate sanitary risks in the community.

To prevent the harmful effect of the production and consumption wastes on the health of the population and environment, the Federal Law on Wastes of Production and Consumption was accepted in Russia in 1998 which determines the legal bases of waste management. The order of the Government of the Russian Federation, 1998 authorizes the plan of preparation of the normative legal acts of the Government of the Russian Federation necessary for realization of this law, providing development of the projects of the documents:

- about the order of licensing of activity under manipulation with dangerous wastes;
- about the order of transbordering transition of wastes;
- about the order of certification of dangerous wastes;
- about the state register of objects of accommodation wastes; and
- about the order of development and statement of the specifications of waste formation and limits on disposal.

In Russia, about five thousand tonnes of waste are imported, and about 200 thousand tonnes are exported to various countries. The regulation of import-export waste is conducted within the norms of the Basel Convention. In 1996, a decree on the State regulation and control of transbordering transportation of dangerous wastes was issued for sanction of export/import and transit of dangerous wastes.

The state policy in the field of waste management is guided by creation of a control system, introduction of perspective resource saving and low wastes technologies, effective means and methods of processing and rendering them harmless. The ecological control of waste management covers all kinds of activity connected with formation, accumulation, storage, processing, transportation and burial of wastes of manufacture and consumption.

# SINGAPORE

Singapore is a densely populated island nation with over 3 million resident population. The warm and humid climatic condition which pervades Singapore throughout the year makes refuse extremely putrifiable. The large quantity of refuse generated has to be removed and disposed of quickly, efficiently and safely before it gives rise to smell, vermin, infectious diseases and other public health hazards.

Over the last thirty years, Singapore has seen rapid industrialisation and urbanisation and high economic growth. These have brought about a wide range of environmental problems which include escalating domestic and industrial waste outputs. During the same period, the daily refuse output doubled every decade. It was 1,600 tonnes per day in 1972 and 3,200 tonnes per day in 1982. In 1992, this has risen to 6,200 tonnes per day. Daily refuse output in 1998 stood at 7,660 tonnes per day. With population growth and an expected sustained good economic performance, the refuse output in Singapore is expected to rise.

Solid waste management has now evolved into a high-level automation of storage, removal and disposal. Roll-off refuse compactors and dust-screw refuse handling facilities are now widely used. Most of the refuse trucks are equipped with compaction device and some with radio communication system. All the refuse are disposed of either at the incineration plants or at the sanitary landfill.

## Refuse Collection

Prior to 1 April 1996, domestic and trade refuse were collected by ENV. Private waste collectors removed the remaining refuse which were mainly from industrial and commercial premises, shopping complexes, shipyards and construction sites. However, faced with an ageing workforce and difficulties in the recruitment of workers, the solid waste collection service of the Ministry was corporatised. On 1 April 1996, SEMAC Pvt. Ltd. took over from the Ministry, the collection of municipal waste. Services are monitored by ENV as the regulator.

To introduce competition in the refuse collection services and improve the service standards, ENV started to liberalise the service in 1998. Domestic and trade premises were divided into nine geographical sectors with the aim that the refuse collection services would be progressively tendered out within the next two to three years. Already, the tenders for refuse collection services in the Pasir Ris-Tampines and Bedok sectors had been awarded and the contracts commenced on 1 July 1999 and 1 November 1999, respectively.

## Refuse Disposal

All the refuse collected are disposed of at disposal sites operated and managed by the Ministry. The disposal sites comprise a sanitary landfill at Pulau Semakau and three incineration plants at Ulu Pandan, Tuas and Senoko.

In 1998, the three incineration plants processed a total of 1.88 million tonnes, *i.e.* 66.3 per cent of the total refuse generated in Singapore. The rest of the refuse was disposed at the Lorong Halus Dumping Ground. The dumping ground has reached its capacity and closed since 1 April 1999. The Ministry now operates 350 hectare offshore sanitary landfill of Pulau Semakau, as well as a marine transfer station at Tuas, built at a total cost of $ 840 million. The marine transfer station receives and processes non-incinerable refuse and incineration ashes before they are barged to Pulau Semakau. The offshore landfill is expected to see Singapore's needs beyond the year 2030.

To ensure that there is sufficient capacity to cope with the relentless increase in the refuse generated, Singapore is building its fourth incineration plant. The new Tuas South Incineration Plant will cost $ 1 billion and will be one of the largest in the world. The plant will have six incineration/boiler units capable of incinerating a total of 3,000 tonnes of refuse a day. The waste heat from the incineration process will be used to generate about 80 MW of electricity, of which 20 MW will be consumed by the plant and the remainder sold to Singapore Power. The incineration plant is expected to commence operation in the year 2000.

# THAILAND

In the past decade, Thailand was faced with various environmental problems mainly caused by institutional failure. The policies, rules and organizations created to protect the environment have not performed with a great deal of success. As a result, Thai governments have committed themselves in passing various environmental laws and regulations to cope with the problems concerned, most significantly the Environmental Act of 1992 which has increased authority in environmental management. Also, the government has come up with a practical policy and announced the use of the 'polluter pays' principle. Another example is the 'beneficiary pays' principle.

Public participation inevitably plays a crucial role in environmental management at many levels—from the right to receive information to the right in participating in decision-making process—on large scale projects which have an impact on the environment. At the same time, the government should use educational approach as well as public relation mechanisms to raise the public awareness of their responsibilities and rights.

Thailand has adopted and implemented a positive approach on environmental management focusing on the prevention and control of the cause of environmental degradation with concrete measures and principles.

The protection of the environment is crucial for sustainable development. The Thai Government has recently adopted a twenty-year Plan for the Enhancement and Conservation of National Environmental Quality (1997–2016). According to the Plan, appropriate ways and means to cope with the environmental problems should be accelerated. Environmental awareness and the use of appropriate technology should be emphasized. A sense of responsibility and ownership should be created in order to extensively raise public awareness and participation. At the institutional level, government agencies and relevant sectors responsible for the environment and natural resources must be reformed in order to improve their efficiency and effectiveness. It is also vital to renew and adjust outdated laws, regulations and rules which obstruct the conservation and sustainable development of natural resources and environment.

# VIETNAM

Vietnam has 61 provinces and municipalities under direct State management of the Central Government. There are about 570 large and small cities; of these, 19 are municipalities. According to the 1996 statistics, the quantity of solid waste generated in cities and towns is about 19,000 tonnes per day. These include 10,200 tonnes of industrial wastes, 250 tonnes of hospital wastes and 9,000 tonnes of garbage from households.

In general, in cities and towns of the country, the collection of solid wastes is organized. The proportion of solid garbage collection remains considerably low (about 40-60 per cent) and wastes are not yet separated. Several treatment methods for disposal of solid wastes are being applied such as—free burying, hygienic burying, waste compost to produce fertilizer, incineration and anaerobic decomposition and treatment of organic wastes under high temperature and pressure. However, at present, in the urban areas the hygienic burying method is used. Certain cities already have a factory for the transformation of wastes to produce fertilizer. For example, Cau Dien Waste Treatment Factory in Hanoi which began to operate since March 1993 with a capacity of 30,000 tonnes of waste per year is capable of producing 7,500 tonnes of fertilizer per year.

There is a proposal to build, in the near future, more solid waste separation establishments to recycle wastes into organic fertilizer and to incinerate hospital wastes.

The National Assembly of Vietnam has passed some laws and ordinances on environmental protection. The Government has also issued legal writings on the treatment of wastes in urban areas and industrial zones, including the Law on Environmental Protection of 1993. There are also several decrees, decisions of the Government, and instructions of the Prime Minister guiding the implementation of the law on environmental protection.

At the annual year-end sitting, the National Assembly reviews Report on the implementation of environmental protection and management conducted by the related governmental institutions. Members of the National Assembly question them on how far the situation has improved. The treatment of wastes in urban areas and industrial zones is among the issues addressed.

Parliamentary supervisory groups are organized to work with Ministries, branches and regions on environmental issues in general or specified supervisory moves on environmental issues which are seen as pressing problems. This activity may be supervision on treatment of wastes in traditional handicraft villages, factories, industrial zones and urban sub-areas. Through supervision activities, the Parliamentary Committee has co-ordinated closely with the Ministry of Science, Technology and Environment in implementing environmental protection in general and management of wastes in particular. In 1999, the Committee worked with the Ministry of Science, Technology and Environment to seek solutions to recommendations by supervisory groups from the Committee.

However, in the years to come, the management of wastes in urban areas and industrial zones in Vietnam needs further attention and supervision from the National Assembly in the following fields:

(i) to work out plans for construction of hygienic disposal dumps in provinces, cities and also on a nation-wide scale;

(ii) to strengthen State management, at the regional level, of household and industrial wastes;

(iii) to make recommendations to the Government for further investment to build a system of treatment of household waste water in large cities and urban areas; at the same time, priority is given to garbage collection and transportation, including separation of solid wastes in cities and towns; and

(iv) to consider carefully solutions for incineration of household solid wastes, as well as wastes from health-care activities and hazardous wastes to ensure that these will not cause secondary pollution from rejected gases and dust.

Vietnam is stepping into the period of industrialization and modernization and is fully aware of the importance of combining socio-economic development and environmental protection to ensure sustainable development.

# THE CHIANG MAI DECLARATION ADOPTED AT THE SEVENTH APPCED

# THE CHIANG MAI DECLARATION

We, Members of Parliament and Conference participants representing countries from the Asia-Pacific Region at the Seventh General Assembly of the Asia-Pacific Parliamentarians' Conference on Environment and Development (APPCED) in the City of Chiang Mai, Thailand from 20th to 23rd November 1999, having discussed the theme "Waste Treatment and Garbage Disposal in the City" with a shared concern for the rapid aggravation of environmental problems in cities of the Asia-Pacific Region:

**Recognizing** that environmental problems have been critically escalated at the global as well as at national and regional levels, posing challenges to the effectiveness of international goals and norms for protecting global environment,

**Taking into account** that the quantities and complexities of waste and garbage being generated daily have increased rapidly with the economic development and unsustainable pattern of production and consumption,

**Aware** that urbanization and industrialization have contributed to a large extent to the aggravation of environmental pollution, and the mega burden on urban waste treatment and garbage disposal,

**Mindful** that environmental problems in the cities caused by imprudent and indiscriminate use of resources have led to futile generation of all forms of waste and garbage, which adversely affect the ecological balances and the quality of life of the peoples as well as the economic and social development of the nations,

**Noting** that the contamination through wastes from domestic and industrial sources can have detrimental effects on the ecosystem and human health,

**Noting further** that the causes of the mounting problems of waste treatment and garbage disposal in some cities are attributable to the lack of national and local capacities to handle and manage them; deficiencies in regulatory frameworks; insufficient education and training programmes; poor coordination between public agencies;

inadequate knowledge about environmental contamination and pollution and the appropriate technologies; unorganized handling of waste treatment and garbage disposal management; and most importantly the lack of public awareness and participation,

**Reaffirming** our support for **Agenda 21: Programme of Action for Sustainable Development** and the **1992 Rio Declaration on Environment and Development,** which set out a blueprint for global sustainable development into the 21st Century and guidelines for environmentally sound management of all kinds of wastes,

**Stressing** the need for all countries involved to develop institutional structuring and programming to respond to the recommendations of international agreements,

**Considering** the formulation of suitable policies and legal and administrative arrangements for waste management, aimed at encouraging both Governments and Parliaments to adopt specific measures for waste management, while making them aware of the grave problems to the environment caused by the rapid growth of large cities,

## Do hereby:

**Call upon** parliamentarians to take the lead in modernizing laws and regulations; adopting innovative approaches and policy guidances for improved environmental management; promoting the role of local governments, municipalities and city administrations in waste and garbage management; encouraging and increasing public and private sectors' participation, including NGOs, in the promotion of appropriate waste treatment and garbage disposal,

**Urge** Governments to develop incentives and compliance mechanisms for waste minimization,

**Urge** each local authority to enter into dialogues with its citizens, local organizations, and private enterprises and to take steps for the formulation of "a local Agenda 21",

**Call upon** urban communities to develop effective environmental management system for protection and restoration of environment,

**Further call upon** entrepreneurs to voluntarily participate and expedite their roles towards cleaner production,

**Encourage** efforts to minimize waste and garbage generation such as:

— Introducing recycling programmes at educational institutions, communities and commercial sites,

— Using clean technology to reduce waste generation,

— Widely using recycled materials,

— Promoting public participation and awareness programmes for waste reduction in communities, institutions, industries,

— Introducing economic instruments and various incentives to reduce waste and garbage in urban areas,

— Urging people to separate all waste at sources to facilitate recycling and treatment,

**Call upon** countries in Asia-Pacific Region to strengthen the networking of information and environmentally safe and sound technology for waste and garbage management.

Done in the City of Chiang Mai,
Thailand
22 November 1999.

## *Annexure*

### APPCED Member Countries

Australia

Bangladesh

Bhutan

Cambodia

Canada

Chile

Commonwealth of Northern Marianas

Cook Islands

Federated States of Micronesia

Fiji

India

Indonesia

Islamic Republic of Iran

Japan

Kingdom of Tonga

Lao People's Democratic Republic

Malaysia

Mexico

Mongolia

Nepal

New Zealand

Norfolk Island

Pakistan

Papua New Guinea

People's Republic of China
Philippines
Republic of Iraq
Republic of Kazakhstan
Republic of Kiribati
Republic of Korea
Republic of Kyrghystan
Republic of Marshall Islands
Republic of Nauru
Republic of Palau
Republic of Peru
Republic of Vanuatu
Russian Federation
Samoa
Singapore
Solomon Islands
Sri Lanka
Syria
Thailand
Tuvalu
U.S.A.
Vietnam

*The hope for the future of environment in our country is based on many positive factors–our rich biological diversity and natural resources, increasing number of peoples' movements focusing on environment, greater public and media concern for these issues and the spread of environmental awareness among children and youth.*

*–G.M.C. Balayogi*