

# **MAURICE ILE DURABLE**

**CONSULTATIVE WORKSHOPS  
14 JUNE – 29 JULY 2011**

## **Working Group 3 ENVIRONMENT**

**Final Report**

**10 August 2011**

# **DEVELOPMENT OF MAURICE ILE DURABLE (MID) POLICY, STRATEGY AND ACTION PLAN**

## **MAURICE ILE DURABLE CONSULTATIVE WORKSHOPS**

### **Report of MID Working Group 3- Environment**

#### **Preamble**

The Republic of Mauritius<sup>1</sup> is regarded as one of the most performing African country and is considered worldwide as an example of economic success, political stability and peaceful cohabitation. However, improvement is much needed with regards to pollution, waste and environmental health on the small island republic Maurice Iles Durable (MID) is a national strategic project initiated in 2007 to make Mauritius a model of sustainable development. The MID project has committed to mainstream sustainable development with particular focus on 5 main issues namely on energy, environment, employment, education and equity . In order to elaborate its strategy, policy and action plan, a green paper on Mauritius was published to henceforth serve as a working document for the further consultative process with the different stakeholders. Prepared in April 2011 by the Prime Minister's Office in collaboration with the Ministry of Environment and Sustainable Development the stage of consultation was implemented in June and July 2011 through 6 working groups to cover the "5E".

This report presents the findings of working group 3 which had the mandate (see TOR pg) to work on the environmental aspects of pollution, wastes, environmental health and embellishment of the environment.

The deliberations of the participants have led to the identification of gaps on environmental issues and proposals on sustainable remedial measures through the proposition of short term, medium term and long term projects.

---

<sup>1</sup> The terminology of "Republic of Mauritius" and "Mauritius" as mentioned in this report refer to the whole national territory of the country namely the main island Mauritius and its dependencies Rodrigues, Agalega and Saint Brandon, except if mentioned specifically.

Thus, the outcome of the reflections of the Working Group on environment is of utmost importance in the MID architecture.

### **1. Acknowledgement**

Special thanks are addressed to all the people who participated and contributed to the consultation meeting and have made this report possible.

### **2. Composition of Animation Team**

The animation Team was composed of:

Dr N. Jaypaul, Chairman, Director Health Services, Ministry of Health and Quality of life

Mr P. Kowlessar Vice Chairman, Director Solid Waste Division, Ministry of Local Government and Outer Islands

Dr B. Lalljee, Rapporteur, Director Consultancy and Contract Research Centre (CCRC)  
(UoM)

Mr A. Maudho, Rapporteur, lecturer Geography - GIS (UoM)

Mrs D. Tatur-Ramasamy, Facilitator, Environment Officer (MOESD)

Mrs R. Brizmohun, Facilitator, Scientific Officer (MOESD)

Mr S. Mooloo, Resource Person, Deputy Director (MOESD)

Mr Y. Pathel, Resource Person, Divisional Environment Officer (MOESD)

Composition of the Working Group 3 is listed at Annex 2

### **3. List of acronyms**

AQI	Air Quality index
BLP	Building & Land Use Permit
CCRC	Consultancy and Contract Research Centre
CDD	Contrat de Délégation
CFC	Chlorofluorocarbon
CIDA	Canadian International Development Agency
CMOD	Convention de Maîtrise d'Ouvrage Déléguée
CO	Carbon Monoxide
CO2	Carbon Dioxide
CWA	Central Water Authority
DDT	Dichlorodiphenyltrichloroethane
DFR	Design for Recycling
EDP	Effluent Discharge Permit
EIA	Environmental Impact Assessment
EIS	Environmental Information System
EPA	Environment Protection Act
EPR	Extended Producer Responsibility
ESA	Environmentally Sensitive Area
HCFC	Hydrochlorofluorocarbon
HIA	Health Impact Assessment
IA	Irrigation Authority
ICZM	Integrated Coastal Zone Management
IOC	Indian Ocean Commission
MEPU	Ministry of Energy & Public Utilities
MITD	Mauritius Institute of Training & Development
MID	Maurice Ile Durable
MoESD	Ministry of Environment and Sustainable Development
MRC	Mauritius Research Council
MRF	Material Recovery Facility
MSIRI	Mauritius Sugar Industry Research Institute
MSW	Municipal Solid Waste
NCP	National Consultation Process
NDS	National Development Strategy
NEAP	National Environmental Action Plan
NEL	National Environmental Laboratory
NEP	National Environment Policy
NES	National Environmental Strategies
NGO	Non-Governmental Organisation
NNSD	National Network for Sustainable Development
NOx	Oxides of Nitrogen
NPDP	National Physical Development Plan
NSP	National Sewerage Programme
NTA	National Transport Authority
PER	Preliminary Environmental Report
PET	Polyethylene Terephthalate
PM	Particulate Matter
PMO	Prime Minister's Office
POP	Persistent Organic Pollutants
PPG	Planning Policy Guidelines
PPP	Public and Private Partnership
RDA	Road Development Authority
RRA	Rodrigues Regional Assembly

## 4. Table of Content

1. Acknowledgement .....	3
2. Composition of Animation Team.....	3
3. List of acronyms .....	4
4. Table of Content.....	6
5. Executive-Summary .....	8
6. Schedule of meetings:.....	18
7. Introduction .....	19
8. List of themes/sub-themes addressed by Working Group 3 .....	22
9. Pollution: a major problem to tackle through a series of measures.....	23
9.1. Air Quality.....	23
9.1.1. An existing framework which needs to be properly enforced. ....	24
9.1.2. Gaps and constraints related to air quality; the different sources of air pollution.....	25
9.1.3. Recommendations and way forward: <i>Urgent and immediate measures towards the improvement of air quality</i> .....	28
9.2. Wastewater: <i>A wastewater regulation, policy and strategies to be further completed through a National Sewerage Programme.</i> .....	30
9.2.1. Existing legal and institutional frameworks.....	30
9.2.2. Progress in the wastewater sector: <i>Implementation of the National Sewerage Programme</i> .....	31
9.2.3. Gaps and constraints related to wastewater.....	33
9.2.4. Recommendations.....	35
9.3. Noise.....	37
9.3.1. Existing legal and institutional frameworks.....	37

9.3.2.	Gaps and constraints related to noise pollution .....	37
9.3.3.	Recommendations .....	39
9.4.	<b>Marine Pollution: <i>Harmonization needed to review scattered responsibilities</i></b> .....	40
9.4.1.	Existing legal and institutional framework .....	40
9.4.2.	Main progress to tackle marine pollution.....	41
9.4.3.	Gaps and constraints related to marine pollution: <i>a lack of monitoring and enforcing mechanism</i> .....	43
9.4.4.	Recommendations and <i>immediate actions needed to address the problem of marine pollution</i> .....	45
9.5.	<b>Odour : <i>a problem to be tackled at source</i></b> .....	46
10.	<b>Solid Wastes: <i>Management of a sorting, collection, transport and disposal system to be reviewed</i></b> .....	47
10.1.	Existing legal and Institutional framework.....	47
10.2.	Existing Strategies, projects and progress.....	47
10.3.	Gaps and constraints related to solid waste .....	50
10.4.	Recommendations .....	51
10.4.1.	Storage, collection and transportation of solid waste .....	51
10.4.3.	Waste prevention, minimization, re-use and recycling .....	54
10.4.4.	Special and hazardous wastes .....	56
11.	<b>Environmental health: <i>reducing health threats on the population</i></b> .....	59
11.1.	Overview and gaps.....	59
11.2.	Recommendations .....	62
12.	<b>Embellishment of the environment: <i>placing people at the centre of development</i></b> 63	
12.1.	Overview and constraints.....	63
12.2.	Recommendations and proposals to enhance quality of life .....	64
13.	<b>Conclusion</b> .....	67
14.	<b>Annexes</b> .....	68

## **5. Executive-Summary**

The MID project is a national project and a ‘projet de société’ initiated by the Prime Minister in 2007 and is steered from the Prime Minister’s Office.

This report represents the deliberations, findings and recommendations of Working Group 3, environment 2.

Economic development in Mauritius has impacted on the environment of Mauritius (physical as well as social). The MID project addresses these issues as well as others, which now is commonly known as the 5E’s (Energy, Education, Employment, Equity and Environment) in a holistic and integrated manner.

The following issues were discussed during the meetings:

Theme 1: Pollution

Sub Theme: Air quality, Waste Water, Noise, Water and Marine Pollution, Odour.

Theme 2: Solid Waste

Sub Theme: Storage, Collection and Transportation of Solid Waste, Treatment (composting, aerobic digestion), disposal. Waste prevention, minimisation re-use and recycling, special/hazardous waste.

Theme 3: Environmental Health

## Theme 4: Embellishment of the Environment

### **Air Quality**

Air quality in Mauritius was a concern expressed by the participants especially with the coming of new industrial activities, electricity generation, medical waste incineration, etc. Although we have Laws, Regulations and institutions (e.g. Ministry of Environment and Sustainable Development (MOESD), and the National Environmental Laboratory, NEL) mobile air monitoring units (APMU) and laboratories for air quality (No<sub>x</sub>, Co<sub>x</sub>, So<sub>x</sub>, PM<sub>10</sub>) we still have problems with air quality and air pollution in Mauritius and Rodrigues.

These regulations need to be revisited, strengthened and application of same made more stringent.

The following recommendations were agreed on:

All existing legislations should be applied and enforced and an air quality index should be established in Mauritius and Rodrigues. It is well known that fuel containing lead and high sulphur level are pollutants both to the environment and human beings.

Quality of Fuel must be enhanced and a category 'A' Diesel introduced..

Traffic congestion should be reduced and peak time could be eliminated by decentralization of activities away from the capital, and introduction of flexi-time and home working. The positive steps taken by the Government through construction of new roads, e.g, Ring Road project and fly-overs were recognised.

A special environmental fund should be created to finance environmental and conservation projects. Hence, funding mechanism should be improved and more funds should be made available. Allocation of these funds must also be made transparent.

Furthermore, the burning of sugar cane prior to harvest must be stopped through Regulation. The positive steps taken by the Government to increase the penalty for deliberate fire in sugar cane fields by vandalism was a strong sign of the Government's commitment and willingness to reduce pollution.

Specification of imported coals should be reviewed to improve quality of emission from power stations, especially with regards to sulphur content.

Government should start implementing the energy action plan to encourage and target projects on renewables and green energy such as ethanol, wind, solar energy, geothermals, etc.

Bicycle paths should be created in various paths of Mauritius both for health reasons and reduce pollution from vehicular emissions.

The project for tree plantation should be continued and improved as trees sequester carbon dioxide and release oxygen during photosynthesis thereby purifying the environment.

### **Waste Water**

The issue of waste water (generation, treatment, utilisation and disposal) was discussed. The Ministry of energy and Public Utilities (MEPU) is the enforcing agency for environmental legislation related to inland waters and discharge.

Several gaps were observed in this sector including the inefficient use of waste water for irrigation and the pricing policy. The bottlenecks for the implementation of the sewerage systems were examined.

The following proposals / recommendations were made in respect to above sector.

In the short term, by 2015, it is proposed that:

All existing Regulations with respect to waste water should be enforced to have a more effective, efficient waste water management in line with the MID policy. The implementation of the sewerage master plan should be improved to include factories, new construction and development. The quality standards for treated waste water should be enhanced with compulsory standards of waste water.

Landfill disposal of sludge must be banned until a new environmentally friendly disposal system is adopted. It has been shown elsewhere that landfills are not the most efficient waste disposal system.

Onsite disposal consisting of septic tanks, absorption pits or leaching field must be banned in a phased manner to improve the benefit of regional and national sewage treatment plants as well as ground water quality.

The use of treated water for irrigation of sugar cane should be compulsory to protect fresh water resources for domestic utilisation.

A study should be undertaken to assess further the use of treated water for other crops as treated effluents can be harmful. This study should be included in the water study by MRC as concerns that treated water that is in direct contact with human beings is considered as potentially dangerous.

Education and awareness campaigns should be an on-going process, especially with respect to use of waste water.

New policies should be formulated so that fines are imposed proportionately to the concentration of pollutants in the effluents. This may require enactment of new laws and regulations. Furthermore, a scientific study is proposed to evaluate the strengths and weaknesses of the polluter-pay principle and recommendation of remedial measures.

The reuse of treated effluents for industrial and other use such as fire, sylviculture, car washing should be encouraged. This may again require Government Regulations.

Equipments and infrastructures of sewerage treatment plants should be regrouped to enable economy of scales. This may require the consensus of all stakeholders for such an activity. Recycling and treatment plants should be compulsory whatever the size of a company or industry.

## **Noise**

Noise was considered as an annoyance for public tranquillity and also as a cause for irritation. Although Laws and Regulations exist, implementation, responsibilities and other issues were raised which need improvement. The Ministry of Health and Quality of Life (MoHQL) is the enforcing agency. Noise emanating from the following:

Sound proof measures should be promoted to contain sound transmission to the environment.

Education, awareness and civic values campaigns should be organised as a on-going process for societal harmony and respect for the neighbour. Communication mechanism for the public at large should be reviewed and made more effective.

Existing regulation on noise monitoring should be reviewed, implemented and reinforced.

The land-use planning act should be reviewed with regards to conflictual localisation of industrial zones and residential zones. Buffer zones between incompatible land uses must therefore be demarcated and respected.

Communication mechanism towards the public that a construction will be done should reviewed and improved.

A Study of the impact of noise on health should be undertaken for all major activities.

Monitoring and control of noise (motorcycles, car exhaust pipes, nightclubs, Ice Cream vans) should be enforced and appropriate penalty imposed.

Road noise barriers should be erected for the welfare and health of residential zones adjacent to such roads.

### **Marine Pollution**

It was observed that for marine pollution, Regulations / Laws were scattered over several ministries/agencies and no coordinated efforts exist.

Setbacks for high water mark should be increased for all new coastal projects as this will protect beaches and other infrastructure in case of tidal waves or tsunamis and also for improvement of recreational activities. Non polluting aquaculture activities to be implemented in all aquaculture projects. Such non-polluting aquaculture activities should also be included in the Aquaculture Bill of the Ministry of Agro-Industry and Food Security (MOAFS).

Sea dredging and excavation policies should be reviewed and reinforced to protect sea water biodiversity as well as its adverse effect on fish caught by fishermen.

Deforestation and destruction of mangroves should be prevented by enforcing regulation and application of the Forest policy.

Certain practices such as use of certain solar creams by tourists have been shown to be detrimental to the marine environment. This should be studied further and remedial measures taken.

Pleasure boats need to be fuelled by better quality fuel. Similarly, certain activities in the sea such as servicing of ships engines should be closely monitored.

Research should be carried out on the development and reuse of brine. The brine is a by-product of desalination plants. Studies should be carried out for a safe disposal/ reuse. An example would be to dispose this in borehole of saline aquifer.

Education and awareness campaigns should be promoted to inculcate the notion that sea and rivers are not dumping bins.

Imposition of desalination plants for all new coastal hotels should be implemented. Although this measure has already been imposed by the cabinet, the working group proposes to reconsider the imposition methodology and guidelines. All new morcellement permits should be accompanied by a rainfall and run-off water channelling and disposal system.

## **Odour**

Odour especially emanating from farming and industrial activities were issues of concern. The Laws/Regulations need to be implemented and enforced. Furthermore, the following recommendations were made;

A prior treatment to control odour from certain activities should be implemented with immediate effect.

The Land Planning Act should be reviewed to locate such activities away from residential areas.

## **Solid Wastes**

The issue of solid wastes retained considerably attention. The enforcing agency of the above issue is the solid waste management division of the Ministry of local government and outer islands and the local authorities. The MOLG is currently in the process of finalising its strategy for the management of solid waste in Mauritius for the next five years. The following is being considered for efficient solid waste management.

Closure of open dumps, construction of sanitary landfills, construction of additional transfer stations, increase in collection coverage and frequency, disposal of specific types of solid hazardous waste in specially designed cells, increased public awareness on solid waste management 3R concept (Reduce, Reutilise, recycle).

The proposed large composting plant which will process about 100,000 farms of MSW (Municipal Solid Waste) was considered. It was stated that two more such composting plants are expected to be in action in the future. The issues of hazardous waste, the Dangerous Chemicals Control Act (2004) were mentioned as well as the project of the POP (Persistent Organic Pollutants) in Mauritius.

Participants identified certain gaps in the solid waste management in Mauritius. This included the inefficient waste collection, lack of machinery, equipment and trained human resources.

Illegal dumping and land which has been converted to waste disposal site should be controlled and existing laws should be applied more firmly. The following recommendations were proposed to make solid waste management more efficient in the MID project: pg. 39, 40:

Since about 70% of organic waste can be recovered at source, it is recommended to give means to people to recover this waste by providing composters to households through economic incentives for local collectivities and small planters, training and sensitization campaigns.

As a strategy for waste reduction at source, composters at household level should be provided free of charge by local government but people should go and collect their own composters. Training, sensitization and communication should be organized and campaigns should focus on creating awareness and provide initiative on how to selectively separate kitchen and small yard waste while big and large yard waste would be rechanneled to recycling centers. Kitchen and yard waste represent 43% of total domestic waste and only 38% can be recovered. Thus composters will be provided as alternative for carbon / NPK to go into soils for plants.

Financial barriers should be removed for implementation of sorting in household wastes through provision of bins and special plastic bags for different waste types. A target of 50 % of the population could be set in three years time.

Companies exist in the sector of solid waste management in Mauritius but they need incentives as the country represents only a small market. NGOs like Mission Verte provide free bins which are container type bins located at strategic places. Their problem remains in the collection of carton and paper. Incentives exist from “bottlers” companies, this should be extended to newspapers and publicity agencies.

Waste can be converted and turned into resource. This market is not present at the moment, For example, recycling centers can be set up where recyclable solid wastes are recovered and are bought from the population and therefore becoming a monetary resource.

Private initiative should be encouraged in the form of incentives for people to stop wasting. For instance, a grant scheme could be set to purchase shredders and composting units. Subsidies or incentives should be given for buyers to favor recycled products instead of other types. Stewardship of industries and companies is to be inculcated through responsible care. Segregated waste collection is already in operation in Rodrigues.

The Cooperation between the Commission of Agriculture and Commission of Environment in Rodrigues for compost making should be encouraged for waste collection transformation and utilization

Companies and enterprises producing wastes should keep them for disposal. Polluter pays principle should be applicable. Any New dumping site in Rodrigues should be state of the art. A project to send recyclable wastes to Mauritius was evoked. Is it an option, and what are the

costs? Further studies are needed. Awareness raising of the 3R's for waste management should be inculcated in the Rodriguan population.

### **Environmental Health**

Environmental health is a concept that deals with all aspects of the natural and build environment that may affect human health. Following the presentation by Dr Caussy on the above subject, lot of interests were created. It was agreed that for all major programme an SEA (Strategic Environmental Assessor) be made mandatory. This should include an Environmental Health Impact Assessment (HIA). It was also observed that HIA has received little attention. HIA should be made mandatory and an integral part of all HIAs and SEAs.

Strategic Environment Assessment (SIA) should be included within the EPA in all sectors in line with the MID vision.

Epidemiological and health data should be available and accessible to the public. This will create more awareness and make Mauritians health and Environment conscious.

Health Impact Assessment (HIA) should be introduced as a tool encompassing steps and procedures for assessing and reducing the negative health impacts of development projects.

Apart from intersectoral collaboration, the control and monitoring of the quality of imported foods especially before they reach the consumers should be improved. The Food Import Unit control at port and airport should be strengthened while laboratories should be fully equipped and be up to standards to do all the tests. Results should be made available to public at large.

The indiscriminate use of pesticides, is dangerous to the environment which include soils as well as water bodies. Health of farmers is also being adversely affected; some cases of death have been reported and medical practitioners are alarmed by the cancer situation. It is therefore proposed to undertake an immediate control and monitoring of highly dangerous "cocktails" of those pesticides being made by farmers.

The respect of proper clothing and safety measures as per the OHSA by farmers and workers of the local Municipalities and District Councils should be reinforced.

The promotion and training of an Integrated Pest Management System should be monitored by the authorities to bring forward and reinforce the use of predators, parasites and bio-control

microbes. The group also advocated the correct fertilization practice for our crops as this will have an effect on the nutritive values of these crops

By 2020, WG3 proposes that:

An “Observatoire de la Santé” should be created to do research and coordinate and centralize all data related to health.

Through the concept of sustainable agricultural practices the long term the dependency on agro-chemicals for the production of food should be decreased. During consultation on Rodrigues recommendation to use botanical pesticides (e.g. neem) to substitute to chemical pesticides. A study on this proposal could also be applied to the whole Republic.

### **Embellishment of the Environment**

The embellishment of the environment was another such them that guaranteed a lot of interest. Good examples of above undertaken by the government are the green school project the eco-village project.

The Committee proposed the following recommendation to embellish the Mauritian Environment:

The terminology of “embellishment of the environment” theme should be changed to “creating the right living environment” as this way, the essence of putting the people first is captured better. Learning and education should be rendered more attractive with more visits, outings and exhibitions organized regularly. Creation of environment clubs should be encouraged at local level such as in community centres, women association, schools, etc. to promote kitchen and roof gardening.

Each Independence Day should become a “Plant a flower / Endemic Plant day”. In the same vein, all environmental events such as the World Environment Day, Earth Day, Clean Up the World Day etc. should be celebrated.

An appeal to stop cutting pine tree or Araucarias as Christmas trees was made. Instead people can consider buying artificial plastic tree for Christmas which can be used and re-used and last for years.

Beautification contests at local authority level could be organized regularly to identify and reward beautiful buildings which could for instance be put on postcards or other promotional frames.

Although legislation exists, “Syndic” in high-rise buildings and apartment should be enforced. A gap analysis should be undertaken to study the failure of the operation of these Syndic. The study should also propose remedial measures.

Environmental stewardship should be encouraged and promoted. For instance, community involvement should be made in a structured manner such as “comité de quartier” could help in building a feeling of ownership in the proper maintenance and uprisings of residential areas.

The National Network for Sustainable Development (NNSD) should be reinforced to review community projects from NGOs and civil society to attract more visibility.

Sources of funding for potential “embellishment” projects should be made available. Also, fundable projects could be published through MID website.

Guidelines for promoters should be developed, compiled and made accessible.

A Master Plan for the main roads and arteries should be implemented for embellishment. This has to be undertaken in collaboration with the Road Development Authority (RDA). Some and parts of some streets should be pedestrian only. In Rodrigues it was proposed to convert the main road passing through Port Mathurin pedestrian only Pavements should be provided on all roads where possible. Appropriate trees, shrubs, flowers along the roads (with regular maintenance) should be planted. Pedestrian should also respect what it is provided by authorities such pedestrian crossing. Parking on beaches should be banned.

Authorities should conduct surveys and make allowance for sufficient road reserves to allow for bicycle/walking lanes, and proactively enlarge roads where land is still available.

Trees should be planted around major development projects, for example shopping malls. Legislation should be reviewed in that regard to have private promoters to “green” the space.

Possibility of considering one-way streets where possible so that more space is available for planting trees should be studied.

Humps and speed breakers on roads should be eliminated and other systems than roundabouts should be thought about to slow down traffic.

An integrated approach in the design of low-cost housing should be adopted. Housing should integrate a concept associated with the existing natural environment. Maintenance should also be done in the long term.

Projects such as the environmental socio-economic project at la Gaulette and Le Morne under the ICZM / Recomap should be replicated in other region. These projects could start in the short term and remain ongoing.

For Rodrigues it was proposed that building codes for eco-friendly and green buildings need to be introduced. There was a general consensus that Port Mathurin is converted into a Pedestrian Town. Parking provisions for all new buildings need to be enforced.

It was also proposed to review land use planning in Rodrigues and provision of green space in Port Mathurin and possible delocalization of activities from Port Mathurin. Planning should be as per SIDPR or new planning guidelines for Rodrigues to be promulgated.

Mountain Reserves and River Reserves should be protected as per law.

#### **6. Schedule of meetings:**

**DAY 1** - Thursday the 16th of June 2011

**DAY 2**- Tuesday the 28th of July 2011

**DAY 3**- Tuesday the 12th of July 2011

**DAY 4** –Tuesday the 26<sup>th</sup> of July 2011

## 7. Introduction

### *Background: Mauritius and the MID project*

Further to its ongoing development, in 2008, the Prime Minister, Dr. The Honourable Navinchandra Ramgoolam announced his vision of making Mauritius a Sustainable Island – “Maurice Ile Durable” (MID). The main objective of the Maurice Ile Durable concept is to make Mauritius a world model of sustainable development, particularly in the context of SIDS (Small Island Developing States). While the initial thrust was to minimize our dependency on fossil fuels through increased utilization of renewable energy and a more efficient use of energy in general, the concept soon widened to include all aspects of the economic model, society and the environment that are considered to be pivotal in the quest for a sustainable Mauritius.

The MID concept includes a participatory approach towards elaborating a strategy for sustainable development aiming to take on board the whole society in the implementation of this ambitious project. *“The Maurice Ile Durable project belongs not to its conceptors or to Government but to the whole Mauritian nation. It is a social project and is essentially a vision that seeks to transform the environmental, economic and social landscape of the country”* (Dr the Honourable Navinchandra Ramgoolam).

A wide National Consultation Process (NCP) was launched in February 2010 with the aim to come up with a Green Paper, elaborating the needs and aspirations of Mauritian and to develop a Shared Vision on MID. The Green paper was submitted by Prof Odendaal in April 2011 and Cabinet has been apprised of the contents of the document.

The Government now intends to have a concrete MID Policy, a clear ten year MID Strategy and a detailed MID Action Plan to pave the way for the sustainable development of Mauritius. In order to achieve this objective, the Government has constituted six working groups to work out on the following themes, covering the 5Es of MID, namely Energy, Environment, Education, Employment and Equity. Two working groups have been set up for the Environment Sector.

Each Working Group held four one-day workshops from mid June to the end of July 2011, with all concerned stakeholders from Ministries, parastatal bodies, private sector, local communities, NGOs, civil society as well as other associations.

The objective of the Working Groups is to identify the means and ways of achieving the “National MID Vision” and come up with concrete recommendations in each theme which will feed in the process of formulation of the MID Policy, Strategy and Action Plan. The working groups will use the Green Paper and other sectoral policies and strategies as base documents for discussion.

*“The Vision describes an end point to which we all aspire, and provides a beacon along the way. It is an expression of where we want to see our country heading, how we want to live in that country and to a large extent, the kind of people we want to be as a nation. The Vision hence was created through a dialogue between Government and civil society”* (extracted from the Green Paper).

***Working Group 3: how to address the issues of pollution, waste and environmental health in a sustainable way.***

In spite of all the economic achievements of Mauritius, a deeper insight reveals a number of areas that have to be re-visited in particular in the environmental sector. It is essential to identify and investigate those areas so as to be in a position to propose concrete measures and remedial actions to address those key issues in a sustainable way, thereby moving towards a greater management of the environment in Mauritius.

Having no natural resources as such, Mauritius has however a rich inland and marine biodiversity, beautiful landscapes and exceptional lagoons. This unique ecosystem including rare fauna and flora is very fragile and subject to threats from human activities. Moreover, with a rapid increase of its population, expansion and densification of urban areas and the other settlements in rural and coastal areas, a constant pressure is growing on a small territory, less

than 2000 km<sup>2</sup>. The fast development of the country since the 1980s onward has subsequently contributed to the increase of pollution and generation of waste. Furthermore, the management of solid waste is a challenge for Mauritius.

In light of this brief overview it is clear therefore that the active participation and contribution of a representative cross-section of the Mauritian society is required in order to have an objective appreciation of the present status of environment with regards to pollution and solid waste and subsequently environmental health. Hearing from those active at grass-root level is a crucial step towards the identification of the issues/ aspects that are effective, and those that need to be revamped, reviewed or replaced. The primary aim of the working group (WG) 3 on Environment is to collect the views of the key stakeholders in the different areas and to propose recommendations towards the elaboration of a 10-year strategy and 3-year action plan.

It is essential at this point to briefly define the concept of Sustainable Development to better understand the relevance of the environment and the management of the key issues addressed by WG3 namely pollution, waste, environmental health and embellishment of the environment. In 1987, the United Nations released the Brundtland Report, which included what is now one of the most widely recognized definitions:

*"Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs".*

The United Nations 2005 World Summit Outcome Document refers to the "interdependent and mutually reinforcing pillars" of sustainable development as economic development, social development, and environmental protection.

As a result, the environmental implication of pollution and waste impact greatly on economic and social development, constitute serious threats to the natural environment and subsequently to human health.

In the Mauritian context<sup>2</sup>, in spite of the willingness and commitment of one and all to move towards greater management of the environment, there are still several issues clearly lagging behind in terms of sustainable development . Therefore the primary aim of this working group was to take stock of the present situation with regards to pollution, waste, environmental health and embellishment of the environment, identifying the gaps to be filled, and highlighting the main challenges and emerging issues that the Mauritian authorities will have to address. Based on the discussions held, this report also describes the series of concrete recommendations and proposals, which have been prioritised under short-term (0 to 3 years, by 2015), medium term (4 to 8 years, by 2020) and long-term (more than 8 years, after 2020)<sup>3</sup> actions in order to be taken into consideration when elaborating the Maurice Iles Durables strategy, policy and action plan

### **8. List of themes/sub-themes addressed by Working Group 3**

Aiming at the main themes of pollution, waste, environmental health and embellishment of the environment, WG3 has identified sub-themes to overall encompass these challenges. In order to address the main themes, the sub-themes discussed during the 4 working sessions were categorized as follows:

#### **Theme 1: Pollution**

##### **Sub-themes:**

- **Air quality**
- **Wastewater**
- **Noise**
- **Marine Pollution**
- **Odour**

#### **Theme 2: Solid Waste**

##### **Sub-themes:**

- **Storage, collection and transportation of solid waste**

---

<sup>2</sup> The recommendations and proposals made in this report are applicable for Rodrigues as well. However, specific proposals made during the consultative meetings held in Rodrigues are highlighted separately.

<sup>3</sup> ideally, all the recommendations proposed in this report should have started immediately but realistically, some measures take longer to be implemented and therefore have been categorised into short-term, medium-term and long-term measures

- **Treatment (composting, anaerobic digestion), disposal**
- **Waste prevention, minimization, re-use and recycling**
- **Special / hazardous wastes**

### **Theme 3: Environmental Health**

### **Theme 4: Embellishment of the environment**

On the one hand, Air quality, wastewater, noise, odour, water and marine pollution as sub-themes were discussed to address mainly the problem of pollution as a whole.

Solid waste on the other hand was address in a distinct working session where 4 underlying sub-themes were identified, namely the storage, collection and transportation of solid waste; the treatment (composting, anaerobic digestion); disposal, waste prevention, minimization, re-use and recycling of solid wastes and finally special and hazardous wastes.

Finally, as separate themes, environmental health and the question of the embellishment of the environment were discussed.

The following part firstly describes each of these sub-themes separately in order to take stock of existing legal and institutional frameworks, policies, strategies and projects. Secondly, the gaps and constraints pertaining to each of the sub-themes are identified and explained. Finally, a series of recommendations and proposals expressed during the WG3 meetings are listed and prioritised under short, medium and long term.

## **9. Pollution: a major problem to be tackled through a series of measures**

### **9.1. Air Quality**

### **9.1.1. An existing framework which needs to be properly enforced.**

#### ***Legal and Institutional Framework***

The legal framework regulating air quality in Mauritius can be found under the Environment Protection (Standards for Air) Regulations 1998 and the Road Traffic (Control of Vehicle Emissions) Regulations 2002. Furthermore, the Ministry of Environment and Sustainable Development is the enforcing agency for air quality. The National Environmental Laboratory (NEL) of the MOESD is responsible for ambient air monitoring.

At present, NEL is equipped with 3 mobile stations; one Particulate Matter Analyser (PM2.5, PM10 and TSP) – mostly for use near stone crushers; one gaseous analyser – analysis of SO<sub>2</sub>, NO<sub>x</sub>, CO – mostly for use at hotspots; and a newly acquired mobile station still under commissioning for analysis of SO<sub>2</sub>, NO<sub>x</sub>, CO, PM 2.5, PM 10 and TSP. The mobile stations are regularly displaced to sites where high pollution levels are suspected (hotspots). The automatic analysers and equipment at the stations measure the concentrations of major pollutants such as sulphur dioxide, oxides of nitrogen, carbon monoxide, ozone, particulate lead and respirable suspended particles (PM10).

The National Transport Authority (NTA) and Police de L'Environnement are also enforcing bodies in terms of air quality, air pollution and emissions.

The MOESD formulates policies, promulgates regulations and standards, monitors air quality and attends to atmosphere-related complaints. The Police de l'Environnement and NTA monitor vehicle emissions. Standards for air quality have already been reviewed and need to be urgently promulgated.

#### ***Policies, Strategies and Projects***

To reduce emission of pollutants, strategies have been adopted to promote the use of renewable energies and improve energy conservation and efficiency.

The introduction of unleaded petrol in September 2002 and diesel with 500 ppm sulphur content in August 2010 have also contributed to improve air quality. The MOESD is also working towards the introduction of diesel with sulphur content 50 ppm in the near future.

As per the Environment Protection (Industrial Waste Audit) Regulations 2009, local industries are required to develop Environmental Management Plans to better monitor their emissions and take corrective actions.

Preliminary work has been undertaken for development of an air quality index.

Mauritius has successfully phased out CFCs five-years ahead of the scheduled target and is now embarked on a phase out plan for HCFCs.

Even though much progress has been achieved to reduce air pollution, a few gaps and constraints have been identified and urgent actions are required to address same.

#### **9.1.2. Gaps and constraints related to air quality: the different sources of air pollution**

Clean air is a prerequisite for human wellbeing and a better quality of life. However, as Mauritius becomes a more industrialised, urbanised and densely populated nation, maintaining a good ambient air quality becomes a challenge. As an isolated island state, Mauritius is not directly affected by transboundary air pollution, but air quality is affected locally by anthropogenic sources, such as: industrial activities, transportation, electricity generation and occasional sugar cane burning during the harvest season.

A steadily growing population, increasing consumption and production patterns, rising trade in goods and services, sustained industrial development, expansion of the economy and increased mobility, all stimulate energy and transport demands, which are in fact the main drivers of emissions into the atmosphere. These in turn contribute to localised air pollution problems. The most common pollutants include: particulate matter (PM), sulphur dioxide (SO<sub>2</sub>), oxides of nitrogen (NO<sub>x</sub>), carbon monoxide (CO), tropospheric ozone (O<sub>3</sub>) (UNEP, 2007).

Moreover, one of the main gaps is the lack of proper air quality index in the measurement of air pollution in Mauritius.

The challenges listed below are quoted from the recently published Mauritius Environment Outlook. These different sources of pollution have been discussed in plenary session on the WG3's first day of meeting.

### ***Electricity generation***

Mauritius is heavily dependent on imported fossil fuels for electricity generation and in 2009, 82.5% of the total electricity was produced from coal, heavy fuel oil, diesel and kerosene, the combustion of which generate emissions into the atmosphere. Despite the introduction of a tariff structure, energy demand has continued to increase. The dependence on fossil fuel implies that as the economy develops, emission level increases correspondingly.

Furthermore, the gradual shift from diesel to coal due to the latter's lower direct cost per unit of electricity production has contributed to increasing atmospheric emissions.

### ***Industrial activities***

The industries which sustain the growing economy also add to the pollution load and impact on ambient air quality. The majority of industrial estates were set up prior to the establishment of the Environmental Impact Assessment (EIA) mechanism. Moreover, even though a factory is emitting within standards, the lack of buffer between residential and industrial activities affect quality of life of nearby residents due to particulate matter accumulation.

In Mauritius, industries predominately use heavy fuel-oil and coal as fuel source and air pollution problems are mostly attributed to the quality of fuel, inefficient management of boilers and also to a lack of skilled and qualified people to operate boilers. In general, boilers do not operate optimally and use an excessive amount of fuel, thus leading to inefficient use of energy in factories. Furthermore, even though the Department of Environment is the enforcing agency for air quality, it still needs more trained technical staff and monitoring logistics to assess, effectively monitor, enforce and ensure compliance to national standards.

### ***Vehicular Emission***

Exhaust emissions from the transport sector, especially from black smoke emissions from diesel-driven vehicles contribute largely to urban pollution in Mauritius. Furthermore, despite government subsidies for public transport and import duties on vehicles, the growth in the number of vehicles has not stopped. The total number of registered vehicles increased from 123,545 vehicles in 1990 to 366,520 in 2009, representing an increase of 196.7%.

It is also noted that about 40% of the bus fleet is aged between ten to eighteen years. Inferior Fuel quality along with poor servicing, maintenance, overloading, age of vehicles and engine design contribute to air pollution. . The increase in income and standard of living will continue to drive up both vehicle ownership and energy use, thus increasing traffic on roads, more congestion and higher vehicular emissions.

Although measures such as upgrading of fuel quality or the promulgation of regulations have been taken to improve air quality, much remains to be done. The recently adopted carbon tax imposed on new imported vehicles as from July 2011 shows no baseline and has to be more precise. For instance, while the Road Traffic (Control of Vehicle Emissions) Regulations 2002 has been promulgated to monitor exhaust emissions from diesel powered motor vehicles, its enforcement is rather ineffective. In parallel, there is a need to upgrade technical capacity and logistics of all enforcement authorities. Institutional cooperation among the National Transport Authority, Police Force, Police de l'Environnement and Ministry of Environment & Sustainable Development should be reinforced for more coherent enforcement of the regulations, while the State Trading Corporation concurrently imports fuel of better quality.

### ***Sugar cane burning***

In Mauritius, sugar cane burning was a common practice before the harvest season to eliminate trash and increase harvest efficiency, but this trend is now being reversed. Out of the 69,000 ha of sugarcane harvested in 2006, less than 15% was burnt prior to harvest (SEA-MAAS, 2007). Sugar cane burning generates large amounts of air borne particulates or fly ash causing nuisance to the local residential and commercial communities, especially with unfavourable wind conditions as well as pollutants such as: carbon dioxide, carbon monoxide, methane and volatile organic compounds. Furthermore, although cultivation guidelines were given by the MSIRI, no regulations on sugar cane burning exist in Mauritius as compared to Reunion Island.

### ***Medical waste incineration***

Improper medical waste incineration releases pollutants such as: dioxins and furans, metals (e.g. lead, cadmium and mercury), particulate matter, acid gases, carbon monoxide and nitrogen oxides. Locally, medical waste is incinerated on the premises of six hospitals and ten private clinics across the island. A survey carried out in 2009 indicates that some 30,000 kg of medical waste is incinerated weekly in hospitals. The amount of medical waste being incinerated in private clinics was surveyed in 2004 and since then no new inventory has been carried out.

The high organic and moisture content of medical waste and old incinerators lead to inefficient combustion as well as the release of pollutants and odour. Odour nuisances arise from the organic components of the waste such as: human parts, placenta and laboratory cultures. Moreover, since these facilities are located in very close proximity to communities, emissions and odour emanating from the incinerators constitute environmental nuisances adversely affecting ambient air quality and potentially human wellbeing.

This list of challenges, gaps and constraints contributing to air pollution and subsequently affecting air quality have been addressed by WG3. The recommendations and proposals established by the group are reflected in the next section.

#### **9.1.3. Recommendations and way forward: *Urgent and immediate measures towards the improvement of air quality***

The working group 3 on environment has made proposals and recommendations as regards the improvement of **air quality in Mauritius and Rodrigues**.

In the short term, by 2015, it is recommended that:

#### ***Legal and institutional recommendations***

***Recommendation 1:*** All existing legislation should be applied and enforced. Training and capacity building of officers in charge of control and monitoring is also required.

***Recommendation 2:*** A special environmental fund should be created to finance environmental and conservation projects. Therefore funding mechanism would be improved and more funds should be made available. Existing sources of funds like the Environment Protection Fee, car

tyre tax, battery tax, Carbon Tax, etc. should be made available in one fund. Allocation of these funds must also be made transparent and solely used for such purposes.

**Recommendation 3:** Emissions from power plants should comply with existing atmospheric norms. Along with the monitoring status received by the MOESD from each power plant, same can be checked for compliance to standards of emissions. In light of the compliance verification, strategies to be adopted in the future could be decided with for instance the review of specification on imported coals.

**Recommendation 4:** Sugar cane fires must be stopped through proper regulation.

#### ***Economic recommendations***

**Recommendation 5:** Traffic congestion should be reduced for example by decentralization of activities away from the capital and introduction of flexi-time, home working, car-pooling.

**Recommendation 6:** An air quality index should be established

**Recommendation 7:** Quality of Fuel must be enhanced and a category A Diesel introduced. Only good quality fuel should be imported. Catalytic convertors for vehicles should be made compulsory.

**Recommendation 8:** Encourage and target projects on ethanol as bio-fuel, wind and solar energy.

In the medium term, by 2020, it is proposed that:

#### ***Institutional recommendation:***

**Recommendation 9:** Strategic Environmental Assessment (SEA) should be re-introduced in legislation.

#### ***Infrastructure recommendation:***

**Recommendation 10:** Trees should be planted for carbon sequestration wherever possible.

**Recommendation 11:** Bicycle paths should be created to reduce traffic, improve air quality and encourage physical activity

**9.2. Wastewater: *A wastewater regulation, policy and strategies to be further completed through a National Sewerage Programme.***

**9.2.1. Existing legal and institutional frameworks**

Under the Wastewater Management Authority (WMA) Act 2000, no person can discharge or cause to be discharged effluent into the public sewer unless he holds a valid license from the WMA. In addition, the quality of industrial effluents requires meeting the Standards for Discharge of Industrial Effluents into Sewers. The scheduled list of activities that requires a license or an Effluent Discharge Permit (EDP) for discharging effluent into the public sewer and requisite compliance monitoring have been defined in the Wastewater Regulations 2004. In addition, under this Act, no person can construct or allow the construction of a sewer line, Wastewater Treatment Plant or a wastewater disposal system unless in accordance with the prescribed designs or approved by the WMA. Such approval can be granted for scheduled activities at the EIA stage, or at building stage when local authorities request for approval from the WMA prior to granting building permits.

It is to be noted that the Ministry of Energy & Public Utilities (MEPU) is the enforcing agency for environmental legislation related to inland waters and discharge of effluents into the environment. The following legislation is of relevance to the wastewater sector.

- Environmental Protection Act 2002
- Environment Protection – Standards for Effluent Discharge into Ocean (Regulations 2003)
- Environment Protection – Standards for Effluent Discharge onto Land/Underground (Regulations 2003)
- Environment Protection – Standards for Effluent Discharge into Surface Water Courses (Regulations 2003)
- Environment Protection – Standards of Effluent for Use in Irrigation (Regulations 2003)
- Environment Protection – Effluent Limitations for the Sugar Industry (Regulations 1997)
- Public Health Act (2008)
- Local Government Act (2003)

The WMA Act 2000 establishes the WMA as an autonomous organisation under the aegis of the Ministry of Energy and Public Utilities (MEPU) with assigned responsibilities and mandate for the management of the wastewater sector in Mauritius. Thus, the WMA is responsible for the collection through the connection of premises namely domestic, commercial and industrial premises to the sewer system, treatment and disposal of wastewaters in Mauritius. The Authority operates under two (2) legal instruments, signed on August 31, 2001, which regulate the relationship between the WMA and the Ministry of Energy and Public Utilities. These are the “Convention de Maîtrise d’Ouvrage Délégée (CMOD) for construction of new works and “Contrat de Délégation (CDD) for the Operation & Maintenance of the Public Wastewater Systems. The WMA is, thus, an agent empowered by the Government of Mauritius, and operating on its behalf, to construct, operate and maintain sewerage infrastructures with a view to implementing the established National Sewerage Programme. The main objectives of the WMA are to

- Contribute to the sustainable preservation of the fragile environment and of the fresh and coastal waters of Mauritius.
- Halt and reverse the trend of wastewater pollution on the island and its coastal zones
- Improve the sanitary conditions of the population and protect public health.
- Provide a reliable and high quality wastewater service in Mauritius.
- Forge a strong partnership with all stakeholders sensitive to the cause of the environment.

### **9.2.2. Progress in the wastewater sector: *Implementation of the National Sewerage Programme***

In 1989, a need was felt for proper sanitation in Mauritius at the industrial, commercial and household levels. This was raised in the National Environmental Policy (NEP) which aims at fostering harmony between the quality of life, environmental protection and sustainable development for the present and future generations. In parallel, the National Environmental Action Plan (NEAP1) viewed sewage as a major threat to the quality of the water resources and environment in Mauritius.

The Government of Mauritius, thus, undertook a National Sewerage Masterplan study in 1994 so as to elaborate an orderly guide for the implementation of sewerage projects. In this framework, a National Sewerage Programme (NSP) comprising priority projects to be implemented over

a decade was prepared and includes the increase in sewerage coverage of the Mauritian population, and provision of adequate wastewater treatment with the construction of new Wastewater Treatment Plants and upgrading existing ones.

The National Sewerage Programme (NSP) comprises of two (2) phases namely the NSP 1 which has as aim to connect 50% of the Mauritian population to the sewerage network by the year 2015, and the NSP 2 which targets 80% connection to the sewerage system by the year 2033. By implementing the NSPs, the Government intends to protect and preserve the environment and equip the country with a state of the art public sewerage system which is to international standards. Since early 2000, sewerage networks are being established and extended to increase household connection to the public sewer system in the district of Port Louis, part of Plaines Wilhems and Grand-Baie region. Currently, the Mauritius Wastewater Masterplan Study is being updated to assess the existing wastewater facilities, and elaborate a programme for the development and management of wastewater on the main island of Mauritius and Rodrigues for the coming twenty years (2015-2033).

The Ministry of Environment & SD has been entrusted the responsibility to carry out an “Independent Environment Audit on Wastewater Projects” to assess the impacts on wastewater projects on the environment, and to submit yearly reports on the findings on the status of the environment. For this study, the Ministry of Environment & SD works in close collaboration with other stakeholders such as the WMA, CWA, Ministry of Fisheries, WRU and Ministry of Health & QL. So far the audits have shown that there has been an overall improvement in the environment especially with regard to the quality of water bodies with the implementation of the sewerage projects, and that the WWTPs namely at St Martin, Grand Baie and Mt Jacquot are operating satisfactorily with the effluent quality complying with the relevant Standards most of the time (Irrigation, discharge into Ocean and into Underground). However, at the Baie du Tombeau WWTP, the quality of the treated effluent is most of the time not within the permissible limits since the wastewater is treated only at preliminary level and, therefore, requires upgrading. It is to be noted that private WWTPs in hotels treat their wastewaters rather satisfactorily, with the treated effluent being re-used for irrigation purposes of landscaped areas, lawns and golf courses.

### 9.2.3. Gaps and constraints related to wastewater

Treated effluent from Wastewater Treatment Plants (WWTPs) like the St Martin WWTP is of good quality and satisfies the norms for re-use in irrigation. Initially, the treated effluent was sold to the Irrigation Authority (IA) for use by farmers to irrigate sugarcane fields. However, since January 2009, this has not been the case, and the treated effluent was being discharged directly into the ocean via sea outfall. This represents a waste of valuable resource bearing in mind that treatment of wastewater is a costly business. Institutional problems have seized sale of treated wastewater between the WMA and the Irrigation Authority<sup>4</sup>. The reuse of treated wastewater should be explored and, if need be, made compulsory; integrated management of water, watershed and wastewater through a proper coherent policy and strategy is required as the challenge to cope with water security and stress is ever increasing. Besides irrigation, other uses of treated effluent such as fire suppression, dust control, silviculture, horticulture, irrigation of sporting and turf fields, street cleaning, road making, toilet flushing, car/bus washing, cooling towers and underground injection for aquifer recharge, should be considered. However, constant monitoring of the effluent quality should be maintained to ensure levels to the required Standards. The use of treated wastewater is generally accepted by the public; quality assurance should be ongoing in terms of monitoring and control in that regard. It was even mentioned that although legislation makes provision for the re-use of treated effluent for sugarcane cultivation, research should be conducted to find out whether it can be applied to crops. However, the health hazards and risks associated should be investigated altogether bearing in mind the recent emergence of virulent strains of enterohaemorrhagic *E.coli* in Europe.

If acceptance is cleared, the problem remains probably in water/wastewater tariffs. Potable water tariff is probably too low in Mauritius. This perhaps explains why Mauritians use too much water, sometimes more than is required, and shows little consciousness about the need to conserve this valuable resource. The need to review the price of potable water, exercise which has not be undertaken for years, unlike the energy (electricity) sector, was mentioned; if the

---

<sup>4</sup> Discharging of treated effluent from the St Martin WWTP into the Magenta and La Ferme feeder Canals for use by farmers for irrigation purposes has resumed recently due to severe droughts end of 2010 – beginning of 2011.

CWA reviews and raises its price of potable water, the WMA would then be in a position to reconsider selling its water at a cheaper price as compared to that of the potable water. This would prompt people to re-use treated wastewater for applications mentioned above. Also this would ensure financial sustainability of the wastewater sector.

The question of re-use of sewage sludge was also brought forward. Currently some 1000 tons of sludge are being carted away on a monthly basis to the Mare Chicose Landfill which is nearing its containment capacity. In addition, the formation of leachates in the landfill whose pollution load is significant and can seriously pollute neighbouring water bodies and underground water is another issue of concern. The treatment of sludge and its re-use as compost, fertilizer and soil conditioners in agriculture and/or for the production of biogas should be favoured. However, special attention should be given to any associated potential health risk.

In addition, it is to be taken on board, that the implementation of the wastewater projects to extend sewerage coverage in Mauritius encounters several constraints which sometimes delay progress and incur additional costs. Some of the identified constraints are highlighted below.

- It is no easy task to obtain way leaves from Municipalities, Road Development Authority (RDA) and District Councils among other institutions prior to starting works.
- It is a lengthy process to obtain authorization and permission from ministerial and other organisations for undertaking of sewerage works.
- Land acquisition for construction of sewerage infrastructure is a complex and lengthy process.
- There is a nuisance factor during the implementation of sewerage projects such as dust and noise pollution, traffic diversion, loss or relocation of businesses, difficulty to access sites/premises...etc.
- Many underground services (for instance CWA pipes) are not clearly defined; this represents an issue of concern especially during excavation works and laying of sewer pipes.
- Delays are at times encountered due to challenges and court appeals especially during the tendering process.

The above constraints usually lead to delays in project implementation thereby incurring extension in timeframe and at times additional costs.

Considering Rodrigues, it is found that there is no public wastewater collection and treatment system as such. The inhabitants make use of on-site wastewater disposal systems such as pit latrines and septic tanks followed by absorption pits or cesspits. Flush systems exist mainly in the capital Port Mathurin where there is potable piped water supply. It is expected that the updated Sewerage Masterplan Study which would craft the policies and strategies for the National Sewerage Programme, Phase II, and its implementation, would consider establishing sewerage reticulation networks, and Wastewater Treatment Plant in Rodrigues. .

It is to be noted that, in view of considering a re-organisation and management of the water/wastewater sector in a more holistic and integrated manner, the Government of Mauritius is receiving the help of Singaporean Authorities.

#### **9.2.4. Recommendations**

Proposals and recommendations in relation to the wastewater sector are listed below.

In the short term, by 2015, WG3 proposes that:

##### ***Legal and Institutional recommendations***

***Recommendation 12:*** all existing regulations should be enforced

***Recommendation 13:*** The implementation of the sewerage master plan must be improved to include factories, new constructions and development with compulsory standards for wastewater. There should also be more control measures against factories on the coastal zone and throughout the island that might be contaminating the underground aquifers and boreholes

***Recommendation 14:*** the use of treated water for irrigation of sugar cane should be compulsory through proper regulation and enforcement

***Recommendation 15:*** Landfill disposal of sewage sludge must be banned. Alternative disposal systems should be explored.

### ***Economic recommendations***

***Recommendation 16:*** leachate must be managed in an environmentally sound manner, either through the setting up of a leachate treatment plant at Mare Chicose or upgrading of the existing sewage treatment plant at Baie du Tombeau.

***Recommendation 17:*** Onsite disposal consisting of septic tanks, absorption pits or leaching field must be banned to the benefit of regional or national sewage treatment plants. This option should be explored in the short term although the complete implementation would be in the long term.

***Recommendation 18:*** a comprehensive study should be undertaken to assess the further use of treated water for crops other than sugar cane as same may represent a health hazard and be potentially dangerous if it comes to direct contact with the population. This study can be funded by the MRC.

***Recommendation 19:*** Education, awareness and sensitization campaigns on the environmental benefits of good disposal practices into the public sewer system and the possibility of re-using treated wastewater should be an on-going process.

***Recommendation 20:*** Tariff proportional to the concentration of pollutants or pollutant load in the effluents discharged should be established

***Recommendation 21:*** the polluter pays principle should be enforced.

In the medium term, by 2020, WG3 recommends that:

### ***Economic recommendation***

***Recommendation 22:*** The reuse of treated effluents for industrial and other purposes such as fire suppression, sylviculture, car / bus washing, dust control, street cleaning, toilet flushing should be encouraged.

### ***Infrastructure recommendation***

***Recommendation 23:*** Centralization of equipment and infrastructures of sewerage treatment plants should be encouraged to enable economy of scales and cost effectiveness especially in industrial zones.

**Recommendation 24:** Industries, whatever the size, employing water in their process should be equipped with a Wastewater Treatment facility to pre-treat their effluents. .

### **9.3. Noise**

*A framework requiring enforcement, review and respect of civic values.*

#### **9.3.1. Existing legal and institutional frameworks**

The legislation regulating noise in Mauritius are listed as follows.

- Environment Protection Act 2002 amended in 2008– (Standards for Noise Regulations);
- Environment Protection (Control of Noise) Regulations-2008 which take on board inconveniences arising from recreational noise, music played in a loud tone, parties, disco, shriek, shout and use of loudspeakers etc;
- Other legislations are the Business Facilitation Act, the Occupational Safety and Health Act 2005, the Road Traffic Regulations 2002, PPG (including places of worships), and Local Government Act for workshops.

The Ministry of Health & Quality of Life is the enforcing agency for noise and the Police de L'Environnement is the authorized agency under the EPA. To ensure compliance with the Noise Regulations, the Environmental Health Engineering Unit of the Ministry of Health & Quality of Life is equipped with five sound level meters. The Environmental Health Engineering Unit attends to noise complaints received as per established protocol. Where it is ascertained that there is noise pollution, a warning is issued to the contravening party followed by a Programme Notice, Enforcement Notice and/or Prohibition Notice wherever required as per provisions of the Act in case the noise pollution persists. In view of increasing number of noise complaints the Environmental Health Engineering Unit has set up a Flying Squad to attend to noise complaints after office hours and during weekends.

#### **9.3.2. Gaps and constraints related to noise pollution**

In Mauritius, noise is presently the most common environmental problem, as on the average during the last several years, about 30% of total complaints registered at the Department of Environment and the Ministry of Health and Quality of life, were related to noise pollution problems. The main sources of noise pollution in Mauritius are from:

<i>Industrial sector</i>	<i>Multipurpose halls</i>	<i>Animals</i>
<i>Bungalows</i>	<i>Places of entertainment</i>	<i>Power plants</i>
<i>Small and medium enterprises</i>	<i>Domestic sector</i>	<i>Alarm system</i>
<i>Traffic</i>	<i>Aircrafts</i>	
<i>Musical concerts</i>	<i>Religious activities</i>	
<i>Workshops (cabinet making, panel beating, metal, aluminium)</i>		

Very often, the sources are found within residential areas and these directly affect the quality of life of the citizens.

- Land-use planning and management:
  - i. It has been noted that noise complaints arising from the operation of SMEs like cabinet/automotive workshops have increased since the promulgation of Business Facilitation Act whereby the Local Authority is the sole authority responsible for delivering permit based on Building and Land Use Permit (BLP) Guidelines. Yet, though it is clearly spelt out in the BLP guideline that “industrial activity should normally not be located in residential area” same is not being adhered to by the Local Authorities and as a result of which many noise complaints are being received;
  - ii. noise complaints from religious activities being performed in rented private buildings are also being received. However, it is worth pointing out that such buildings were not initially meant to be used as a Place of Worship. Also all places of worship should possess a proper BLP based on guidelines for places of worship as per Planning Policy Guidance meant for this purpose;
- The local Police is not empowered to enforce the Environment Protection (Control of Noise) Regulations-2008 and accordingly many complaints mainly from residential premises and one-off events may remain unattended;

- Proximity and availability: one- off events are usually of limited duration. Intervening in the shortest delay is quite difficult;
- Safety and security implications: taking enforcement measures when a party or recreational activity is in full swing involve certain risks;
- Recurring and unjustified complaints placing strain on time and resources;
- Enforcing of regulations entail significant financial and manpower resources as detailed below:
  - ❑ Costs of providing the service including staffing required,
  - ❑ Transportation costs,
  - ❑ Communication costs e.g. mobile phones.

### **9.3.3. Recommendations**

WG3 recommends that the following measures should be implemented to tackle the problem of noise pollution in Mauritius and Rodrigues by 2015,

#### ***Legal recommendations***

***Recommendation 25:*** Existing regulation on noise monitoring should be reviewed, and enforced. Training and capacity building of relevant officers are also required.

***Recommendation 26:*** Legislation related to land-use planning should be reviewed with regards to conflictual localisation of industrial and residential zones. Buffer zones between incompatible land uses must therefore be demarcated and respected.

***Recommendation 27:*** Monitoring and control of noise (motorcycles, car exhaust pipes, nightclubs, Ice Cream vans) should be enforced.

#### ***Social and economic recommendations***

***Recommendation 28:*** Education, awareness and civic values campaigns should be organised as an on-going process.

***Recommendation 29:*** Communication mechanism towards the public for any new construction should be reviewed and improved.

**Recommendation 30:** Concerning noise from religious activities, the group was in favour of discussion and communication with relevant inter-religious stakeholders.

**Recommendation 31:** A Study of the impact of noise on health should be undertaken

**Recommendation 32:** Noise attenuation and soundproofing measures should be promoted in places where noise level is high.

By 2020, WG3 recommends that:

***Infrastructural recommendation***

**Recommendation 33:** Road noise barriers should be imposed on motorways and heavy traffic roads close to residential areas and institutions.

**9.4. Marine Pollution: *Harmonization needed to review scattered responsibilities***

**9.4.1. Existing legal and institutional framework**

The legal framework for the management of the coastal zone is dispersed over many laws and regulations. The principal laws concerned with the management of the coastal zone are:

Fisheries and Marine Resources Act 2007

Environment Protection Act 2002, as amended in 2008

Beach Authority Act 2002

Tourism Act 2006

Maritime Zones Act 2005

Building Act 1919

Town and Country Planning Act 1954

Local Government Act 2003

Planning and Development Act 2004

The principal ministries, authorities and organisations involved in coastal and marine issues are:

Ministry of Energy and Public Utilities

Ministry of Housing and Lands

Ministry of Tourism and Leisure

Ministry of Environment and Sustainable Development

Ministry of Local Government and Outer Islands

Ministry of Fisheries and Rodrigues

Ministry of Public Infrastructure, National Development Unit, Land Transport and Shipping

National Coast Guard

Mauritius Port Authority

Wastewater Management Authority

Mauritius Oceanography Institute

District Councils/Municipalities

Beach Authority

#### **9.4.2. Main progress to tackle marine pollution**

Several projects have been implemented and progress has been achieved in order to minimize marine pollution. The examples given below are extracts from the Mauritius Environment Outlook.

##### ***Control of development in the coastal zone***

The management tool for regulating large scale development in the coastal zone is already in effect. Many coastal activities are regulated through the EIA/PER mechanism under the Environment Protection Act, while District Councils and Municipal Councils are responsible for issuing the Building and Land Use Permit.

##### ***Integrated Coastal Zone Management (ICZM) Framework***

The ICZM Framework was identified as a priority project in the 1999 National Environmental Strategies. In line with its recommendations, the ICZM Division was established within the Department of Environment in 2002 to spearhead the management of the coastal zone. The Division also has the task of developing an ICZM plan, guidelines for development permits

within the coastal zone, surveying of coastal resources, identifying sources of pollution and their effects on the resources and secure the co-operation of numerous government agencies, the private sector, communities and NGOs and should strongly promote their active involvement.

### ***Shoreline management***

Some 4 km of coastal rehabilitation works, both in terms of soft measures (beach replenishment) and hard measures (rock revetments, gabions) have been carried out by the Ministry of Environment at eight sites, over the last five years and a further 3 km of shoreline are being monitored and assessed for future coastal protection works.

With a view to reduce the impact of erosion on the coastal zone, provision has been made in the National Development Strategy for all new developments to respect a setback distance of 30 m from the high water mark for construction of hard structures and same has been included in Planning Policy Guidance, recommendations of which are being enforced legally. Leveling and removal of sand dunes have been prohibited as part of the coastal zone setback policy.

There is an ongoing programme to lay out vehicular parking at public beaches in order to protect sand dunes. Actions have already been initiated at Flic en Flac, Belle Mare, Mont Choisy and Le Morne public beaches.

### ***Banning of sand mining***

The banning of sand mining since 2001 was an effective decision taken to reduce coastal erosion. Following its ban, the Ministry of Environment and the Fisheries Division have monitored the former mining sites to assess recovery. Surveys carried out by the Fisheries Division have shown that there is regeneration of the marine ecosystem, with colonization of the sandy bottom by seagrasses, macro-algae and corals. An increase in fish abundance was noted together with colonisation from sea cucumbers and sea urchins.

### ***Oil spill contingency planning***

Oil spills are a great threat to coastal biodiversity, fisheries and human health. Mauritius has prepared two contingency plans: the National Oil Spill Contingency Plan and the Port Louis Harbour Oil Spill Response Plan, which provide the framework for oil spill preparedness and response. A Coastal Sensitivity Atlas has also been prepared, which identifies the sensitive resources requiring special protection.

### ***Lagoon water quality monitoring***

Since 1991, the Fisheries Division has been assessing marine water quality to record levels of pollutants and to propose remedial measures. This long-term monitoring project includes the study of: physicochemical parameters at 23 established sites around the island, heavy metals at 8 major estuaries and coliform bacteria at 13 selected public beaches for the safeguard of public users from health hazards. In general, sea water quality around the island is good, confirming that the natural purification and flushing systems are efficient to maintain the environmental equilibrium.

The 23 established sites for physicochemical parameters also include the three major sewage sea outfalls at Baie du Tombeau, Montagne Jacquot and Pointe Moyenne. With the treatment of wastewater prior to discharge via long sea outfalls, lagoonal water quality from Pointe aux Sables to Baie du Tombeau is showing signs of improvement and corals at Baie du Tombeau are now in better condition. The challenge for the coming years is to maintain an improved seawater quality.

In 2009, a Lagoonal Water Quality Index was developed to ease decision-making and policy implementation in addition to communicating lagoon water quality to the public in a simplified manner. In 2010, monitoring was conducted at Pereybère, Mont Choisy, Grand Baie and Trou aux Biches. For 2011, Flic-en-Flac, Albion, Bel-Ombre and Le Morne are targeted and the aim is to monitor 36 sites by 2013.

#### ***9.4.3. Gaps and constraints related to marine pollution: a lack of monitoring and enforcing mechanism***

An analysis of the legal framework for the management of the coastal zone was carried out as part of the ICZM Framework project. It showed that the existing legal framework is sufficiently comprehensive to cope with current legal issues, but recognizes the crucial role of the EIA mechanism and the need to improve monitoring, evaluation and enforcement regimes currently in place.

Degradation of coastal and marine resources are aggravated in the absence of a proper monitoring and enforcement mechanism especially after working hours. At the same time, existing mechanism of coordination and communication in the various decisions and inter-linkages in the activities of the different stakeholders involved need to be strengthened.

Unplanned construction and urbanisation around the northern and eastern tourist zones, land clearing and reclamation have contributed to the degradation of the coastal and marine environment. This degradation is associated to some extent to insufficient monitoring of compliance with licences and enforcement of laws due to a lack of capacity. Even where political will exists, ministries that are responsible for enforcement in the coastal zone are under-staffed and under-resourced. Therefore, the enforcement and monitoring processes need to be strengthened to ensure sustainable coastal development.

Below are some of the issues related to marine pollution listed by WG3 :

- Development along the coastline
- Intensive marine activities
- Impairment on coastal water quality due to land-based activities
- Degradation and backfilling of Coastal wetlands
- Discharge of untreated wastewater into the sea
- River banks erosion causing silting of lagoon in particular in Rodrigues.
- Regional impacts of storm water discharge from some morcellements – catchment area
- Non-respect of setbacks from HighWater Mark, rivers and wetlands
- Bungalows: not connected to sewage system and not having proper wastewater disposal system.
- Pollution from sea based aquaculture farms
- Excessive boat activities (pleasure crafts and hotels)
- Oil spills, cleaning of boats
- Run-off of pesticides/fertilizers from agricultural activities into the sea
- Solar screen protection creams and oils
- Inadequate management of coastal development

#### **9.4.4. Recommendations and *immediate actions needed to address the problem of marine pollution***

WG3 recommends that by 2015, the following proposals should be adopted.

##### ***Legal and institutional recommendations***

***Recommendation 34:*** Setbacks from high water mark should be increased for new coastal projects

***Recommendation 35:*** Sea dredging and excavation policies should be reviewed and enforced with a view to control such activities.

***Recommendation 36:*** Only non polluting aquaculture activities should be allowed.

***Recommendation 37:*** Destruction of mangroves should be prevented through enforcing of regulations

***Recommendation 38:*** Beach related activities should be properly controlled to minimize impact on sea water quality.

***Recommendation 39:*** Use of less polluting fuel for boats should be explored for implementation.

***Recommendation 40:*** Research should be undertaken on the reuse of brine arising from desalination plant

***Recommendation 41:*** There should be proper control of ballast water in terms of invasive species; Findings of the ongoing project by the MOI should be made available to relevant stakeholders

***Recommendation 42:*** Education and awareness campaigns to promote the idea that sea and rivers are not waste bins.

By 2020, WG3 proposes these recommendations to be adopted.

##### ***Legal recommendations***

***Recommendation 43:*** the working group proposes to reconsider the imposition methodology and guidelines for desalination plants for new coastal hotels taking into consideration the high energy use and pollution potential of such practice.

### ***Economic and Infrastructure recommendations***

***Recommendation 44:*** Injection of brine in rejection boreholes to recharge saline aquifer should be investigated through a feasibility study.

***Recommendation 45:*** Rainfall and run-off water in new morcellements should be channeled efficiently. Thorough studies of catchment areas should be undertaken by promoters prior to building new projects therefore.

***Recommendation 46:*** A study should be carried out on the management of pleasure crafts to assess their impact on water quality in the lagoon.

### **9.5. Odour : a problem to be tackled at source**

The question of odour was addressed by the working group on the first day of meeting focused on pollution. WG3 expressed their views on the lack of adequate laws in that matter. The group recommends therefore that by 2015:

#### ***Legal recommendation***

***Recommendation 47:*** a proper legislation should be promulgated and enforced to address the problem of odour.

WG3 agreed that the odours emanating from the use of bio-fertilizers in cane fields is quite accepted by neighbouring population. Nevertheless, in the case of industries or other odour emanating activities, WG3 recommends that by 2015:

***Recommendation 48:*** A prior treatment of foul odour is to be carried out at source

By 2020, the recommendation proposed is:

#### ***Institutional recommendation***

***Recommendation 49:*** Legislation related to land planning issues should be reviewed to locate or relocate such activities away from residential areas.

Furthermore, WG3 stated that the control of pollution in general would help reduce the problem of odour.

**10. Solid Wastes: *Management of a sorting, collection, transport, storage and disposal system to be reviewed***

**10.1. Existing legal and Institutional framework**

Solid waste is regulated in Mauritius through the following legislation.

- Local Government Act 1988 and 2003
- Environment Protection (Standards for Hazardous Wastes) Regulations 2001
- Local Government (Dumping and Waste Carriers) Regulations 2003
- Local Government (Registration of Scavenging Contractors) Regulations 2004
- Environment Protection (Collection, Storage, Treatment, Use and Disposal of Waste Oil) Regulations 2006
- Environment Protection (Polyethylene Terephthalate (PET) Bottle Permit) Regulations 2001
- Environment Protection (Plastic Carry Bags) Regulations 2004
- Environment Protection (Industrial Waste Audit) Regulations 2008

The enforcing agencies are the Solid Waste Management Division of the Ministry of Local Government and Outer Islands and the Local Authorities (District and Municipal Councils).

**10.2. Existing Strategies, projects and progress**

The Ministry of Local Government and Outer Islands is currently in the process of finalising its strategy for the management of solid waste in Mauritius for the next 5 years. The development of such a strategy builds on the achievements that have been made over the past years in the sector of solid waste, namely:

- Closure of open dumps
- Construction of sanitary landfill

- Construction of additional transfer stations
- Increase in collection coverage and frequency
- Disposal of specific types of solid hazardous waste in specially designed cells
- Increased public awareness on solid waste management

Various strategic areas have been identified in view of achieving a more effective and efficient solid waste management system from collection through transportation to treatment/ disposal, reducing reliance on the only landfill of the island through waste minimisation, recycling and resource recovery and improved hazardous waste management.

The first large-scale composting plant in Mauritius that will process around 100,000 tonnes of MSW annually is expected to be operational at La Chaumière by the end 2011. Two additional composting plants are expected to come into operation in the near future.

On the Issue of Hazardous waste, the Dangerous Chemicals Control Act was enacted in 2004 to provide for the prevention of damage to health and the environment caused by dangerous chemicals and for better protection for the workers and the public.

Hazardous waste management in Mauritius is constrained due to the lack of updated information on hazardous wastes and dedicated hazardous waste treatment/disposal facilities. Infrastructure for the disposal of hazardous wastes is limited to a hazardous waste cell at the Mare Chicose Landfill, where only certain types of hazardous wastes are accepted.

Recognising the fact that options for treatment of hazardous wastes are limited locally, owing to the small quantities of hazardous wastes involved, the Ministry of Local Government and Outer Islands favours the grouping and exportation of hazardous wastes for disposal to appropriate entities abroad. The Ministry is in the process of compiling requests for the disposal of hazardous wastes from generators with the objective of grouping all compatible wastes together for safe exportation. Exportation of hazardous wastes for disposal abroad is only feasible when there is adequate volume for exportation. A first exercise of this kind, which consisted of sorting,

packaging, labelling and export of some 5.3 tonnes of school laboratory wastes was conducted in 2010. This has resulted in the clearing of obsolete chemicals, which represented potential fire and environmental hazards on school premises.

The Ministry of Local Government and Outer Islands further carried out a survey on the quantities and types of e-wastes from public and parastatal bodies in view of finding short term solution for the disposal of e-wastes from the Government sector. A tender exercise for the collection, transportation, dismantling and exportation of e-wastes for recycling will be launched soon. The Ministry will build on this experience and will conduct a comprehensive study on the mechanism for the sound management of e-waste in Mauritius. As an example of initiatives being undertaken, a national campaign of “Je recycle les mobiles et les piles” funded by the Mauritius Telecom Foundation under the aegis of the Ministry of Environment and Sustainable Development in collaboration with the Ministry of Local Government and Outer Islands is underway. Initiative as this one should be encouraged, given assistance and support at all levels.

In addition, a national inventory of hazardous wastes will be conducted as from August to November 2011 with a view to developing strategies for the environmentally sound management of hazardous wastes in Mauritius.

### ***Persistent Organic Pollutants (POPs)***

Mauritius signed the Stockholm Convention on Persistent Organic Pollutants (POPs) in 2001 and ratified same in 2004. A National Implementation Plan for the management of POPs, which describes how the country will meet its obligations under the Stockholm Convention to manage and phase out POPs sources in an environmentally sound manner, was prepared in 2005. A four-year project was launched in 2008 to implement the first two priorities from the National Implementation Plan, namely:

- Disposal of obsolete POPs chemicals and decontamination of POPs-affected areas
- Development of alternative strategies for malaria vector management with reduced or no reliance on DDT

Mauritius is party to all three chemical related conventions/protocols: Stockholm Convention, Rotterdam Convention and Montreal Protocol. A number of initiatives/projects are being implemented under these conventions, namely a project on Persistent Organic Pollutants and phasing out of Ozone Depleting Substances.

Mauritius is one of the few countries which has incorporated the *Globally Harmonized System of Classification and Labelling of Chemicals* to ensure that information on physical hazards and toxicity from chemicals are available for better protection of human health and environment during handling, transport and use of these chemicals.

### **10.3. Gaps and constraints related to solid waste**

The main gaps and constraints related to solid waste can be summarized as follows.

There are Inefficiencies in waste collection due to the lack of adequate number and type of waste collection vehicles, personnel and proper supervision. There is also limited waste reduction, reuse, and recycling for the reason that there are no comprehensive legal and economic instruments in place to sustain waste reduction, reuse and recycling. Infrastructure and facilities for separate collection and transport of solid wastes are also limited. Moreover, with limited institutional capacity at the central and local levels, addressing solid waste issues cannot be done effectively

Furthermore, there is inadequate enforcement of laws and regulations governing solid waste management aspects. The lack of database on solid waste management and a proper inventory on hazardous waste add up to the problems. Empty pesticide containers and industrial chemical containers are disposed of in the same way as non-hazardous waste although they can contain toxic residues. No dedicated hazardous waste disposal facility exists and there is inadequate enforcement of the hazardous waste regulations. Therefore, no segregation of hazardous waste at household level is being done. This is also due to limited information, education and awareness on such type of waste in general.

The enforcement of regulations and the proper treatment of solid waste are also caused by limited financing and absence of cost recovery mechanisms.

Finally the problem of illegal dumping and littering is not being tackled properly, there is also a lack of management of medical waste and E-Waste.

#### **10.4. Recommendations**

The working group 3 addressed the problem of solid waste through 4 main issues, namely the storage, collection and transportation of solid waste as a first issue, then its treatment (composting, anaerobic digestion) and disposal as a second issue. It is to be noted that in plenary session, there was a general agreement that priority should be given to the reducing, re-use, recycling of waste and that disposal should be envisaged as a last resort. It was of the opinion that inert/ residual waste should be preferably disposed of by landfilling. The third issue addressed was therefore waste prevention, minimization, re-use and recycling and finally the fourth issue was special and hazardous wastes. Some of the recommendations made are transversal and address all four issues while some are more precise and relate to one particular issue. Therefore, WG3 has proposed the following:

##### ***Institutional recommendation***

***Recommendation 50:*** by 2015 and ongoing, the creation of a Solid Waste National Committee or National Waste Management Board is recommended. This committee should work on a national waste management policy, a waste management strategy including collection, waste minimization and recycling. As proposed, the committee should bring forward an institutional mechanism to involve representatives from local authorities, governmental, parastatal, private sectors, NGOs and other stakeholders under the Ministry of Local Government. A need to have an integrated Solid Waste Management Plan should also be considered a priority for Rodrigues, therefore the following recommendations on solid waste should include Rodrigues as an integral part.

##### **10.4.1. Storage, collection and transportation of solid waste**

On the issue of **storage, collection and transportation of solid waste**, WG3 recommends that by 2015:

***Infrastructure recommendation***

***Recommendation 51:*** Transfer stations can be changed into buy-back or recovery stations and *be redesigned* into secondary Material Recovery Facility (MRF) to reflect its objectives.

***Recommendation 52:*** it is proposed to install collection points in public places, commercial centres and to create centralized drop-off points for recyclables

By 2020, WG3 proposes that:

***Legal and strategic recommendations***

***Recommendation 53:*** in order to standardize services, by 2020, collection methods should be reviewed and be subject to local specification through a proper legislation. There is a need to decentralise the collection, sorting and recovery to exploit the full potential of recycling and reduce the volume of waste going to landfill. The five transfer stations might therefore not be enough.

***Recommendation 54:*** Storage receptacles (bins) should be standardized through application and review of existing legislation.

***Recommendation 55:*** Waste transportation vehicles should also be standardized.

***Recommendation 56:*** Possibilities of mobile shredding of green waste should be implemented to optimize carrying capacity.

#### **10.4.2. Treatment (composting, anaerobic digestion) and disposal of solid waste**

As per the second issue on **the treatment (composting, anaerobic digestion) and disposal of solid waste**, WG3 proposes that by 2015:

***Composting recommendations***

***Recommendation 57:*** As a strategy for waste reduction at source, composters at household level should be provided free of charge. However to make good use of the composters interested people should go and collect their own.

**Recommendation 58:** Training, sensitization and communication should be organized and campaigns should focus on creating awareness and provide initiative on how to selectively separate kitchen and small yard waste while big and large yard waste would be rechanneled to recycling centers. Kitchen and yard waste represent 43% of total domestic waste and only 38% can be recovered. Thus compost generated will help decrease the use of chemical fertilizers. Composting as alternative to chemical fertilizers should also further be inculcated in the Rodriguan population.

**Recommendation 59:** Financial barriers should be removed for implementation of sorting at household level with for example the removal of taxes on bins and recyclable bags for different waste types. A target of reaching 50 % of the population by 2014 was set.

**Economic Incentives** are proposed by WG3 to be set by 2015.

**Recommendation 60:** Companies exist in the sector of solid waste management in Mauritius but they need incentives in that regard as the country represents only a small market. A framework exists from bottlers association, to collect PET bottles for recycling. However, the problem remains in the collection of carton, papers and glass. Therefore, extended producer responsibility should also be implemented to newspaper and publicity agencies as paper waste generating activities to recollect and organize for recycling. On the same level, incentives or preferential rates could be given to service providers to buy composters or shredders to cut big wastes into small pieces.

**Recommendation 61:** As transport costs are going up, the “green tax” collected can be reutilized to remedy this matter and to export treated waste (recycled paper, PET bottles).

**Recommendation 62:** Waste is a valuable resource. recycling centers can be set up where recyclable solid wastes are recovered or annexed to transfer stations and are bought from the population and therefore becoming a monetary resource.

**Recommendation 63:** Private initiative should be encouraged in the form of incentives for people to stop wasting. For instance, a grant scheme could be set to purchase shredders and

composting units. Subsidies or incentives should be given for buyers to favor recycled products instead of other types.

**Recommendation 64:** *Stewardship* of industries and companies is to be inculcated through responsible care. An Extended Producer Responsibility Scheme should be introduced. The principle of stewardship for companies should include importation of product of good standards and also the recovery of the arising waste material. Therefore standards on products to be imported should be developed.

**Recommendation 65:** In order for households to dispose of bulky waste, their collection could be done twice yearly (old TV, fridge, old mattress etc).

**Recommendation 66:** New flat construction should make provision for a separate bin point for all recyclable waste. This facility should be included as a condition in the Building and Land Use Permits (BLP) and should comply with Design For Recycling (DFR) standards. For existing flats, the rule of co-property should be modified to have bins installed. A deadline should be given to invest and put the bins in common areas.

**Recommendation 67:** Selective sorting should be followed by selective collection and treatment, therefore, regulation needs to be promulgated in that regard.

**Recommendation 68:** “Tri Sélectif” or household waste sorting should be promoted through sustained public education. Moreover Waste separation bins should be placed in public places for people to drop their selected wastes. Waste reduction program should also be introduced at the workplace, for instance emails do not have to be printed or double-sided printing on paper should be preferred. At supermarket counters, consumers should be able to drop bags for recycling

**Recommendation 69:** Wastes are secondary raw materials, in the view of zero waste concept, initiatives like the rental of goods instead of sale (e.g. photocopy machines) should be encouraged.

**Recommendation 70:** Green procurement or sustainable public procurement should be favored. Procurement process should include condition on how to dispose or recycle a product; DFR labels / packaging in recyclable products should given advantage or preference.

#### **10.4.3. Waste prevention, minimization, re-use and recycling**

On the third issue, **waste prevention, minimization, re-use and recycling** WG3 has expressed recommendations as to preferably be implemented by 2015.

In the same line of thought as for the recommendations to promote the treatment and disposal of solid waste, initiatives to promote domestic waste prevention and recovery have been expressed.

#### ***Legal recommendation***

***Recommendation 71:*** It is recommended that a strict enforcement of existing laws be adopted.

#### ***Strategic and economic recommendations***

***Recommendation 72:*** further to the introduction of household waste sorting, a system of “dry waste” and “wet waste” could be introduced. The collect of these waste could be done once every 2 weeks for “dry” and once weekly for “wet”. Collection services of recyclable materials could also be introduced at the same time.

***Recommendation 73:*** a study should be undertaken on the feasibility of having industries to pay a disposal fee on non hazardous waste.

***Recommendation 74:*** A product take-back program could be introduced but needs a more aggressive law on used oil (which can be recycled). Facilities like these should be at the disposal of users, consumers and producers. Programs need to be well defined.

***Recommendation 75:*** In view of minimizing waste, non-refundable product charges should be imposed on single and limited use products such as disposable cups, dishes and forks etc. to reach a gradual phase out of these products. Recyclable bin bags should be favored instead of plastic bags. Furthermore, coloured bins made from recyclable materials are not only cheaper but can theoretically be recycled an infinite number of time.

***Recommendation 76:*** Following the same idea of waste minimization, (domestic) water filling station or water fountains could be promoted like fuel station. Instead of having recourse to bottled water, people should be encouraged to have filters on tap and use potable water distributors. This initiative would also promote the reuse of containers such as glass bottles.

***Recommendation 77:*** An environmental conservation fund should be instituted. Taxes and levies should not go into the National Budget but should be channeled and redirected into a new fund. This fund will be a source for funding of waste reduction projects. The management of the fund should be from public and private sectors, NGOs for the principle of transparency.

**Recommendation 78:** Extended producer responsibility could be engaged in shifting the cost of waste management to producers who take the packaging decisions. Therefore, certain products / packaging must be banned from import, as alternative, local made bags should be promoted. A deposit refund system should be implemented for single use packaging materials requiring manufacturers/ importers to pay for recovery. Packaging standards should be set by the Mauritius Standards Bureau for further legislation and enforcement in this regard.

**Recommendation 79:** By 2020, in the long term, organic and recyclable waste should be prohibited at Mare Chicose landfill which should become an ultimate station. To achieve this objective and in the same line of thought as previous recommendations on the collection of waste, waste management should be decentralized with emphasis on recycling in urban regions and composting in rural regions.

**Recommendation 80:** A recycling plant should be implemented in Mauritius and the 5 transfer stations could be redefined as sorting stations through a public-private partnership (PPP) joint-venture. An option to receive recyclable waste from Rodrigues should be studied for implementation.

**Recommendation 81:** On the issue of illegal dumping, it is recommended that an immediate enforcement of the law. Land-owners of bare-lands are also to be fined if their property is not maintained properly or allowed to be used as dumping grounds. Where land owners are not residing in Mauritius and living abroad, laws should be reviewed or new laws should be enacted in this regard. The LAVIMS could be used therefore as database of landowners.

It is essential to understand that solid waste must be taken as a whole process and therefore some of the recommendations may look repetitive from one issue to the other but are transversal and complementary.

#### **10.4.4. Special and hazardous wastes**

On the fourth issue of **special and hazardous wastes**, WG3 proposes that by 2015:

##### ***Legal and Institutional recommendations***

**Recommendation 82:** a National Health Care Waste Management Plan should be established and implemented. This plan should include public and private institutions, monitoring of parameters of incinerator facilities, the training of the operating officers.

**Recommendation 83:** all regulations pertaining to hazardous waste should be enforced.

#### ***Economic recommendations***

**Recommendation 84:** an inventory of all hazardous wastes should be carried out.

**Recommendation 85:** the Extended Producer Responsibility should be implemented for the collection of hazardous waste and collection of these wastes should be professionalized.

**Recommendation 86:** a container management program should be implemented and recycling of the collected containers encouraged. The program should include a special module on the education on planters towards triple rinsing of containers before disposal/collection

**Recommendation 87:** Use of appropriate technology for example the use of enzymes, for the cleaning process of chemical industrial wastes and containers should be promoted

**Recommendation 88:** Those having incinerators including hospitals/clinics need to have an operation and maintenance plan. All operators should therefore be trained and possess recognized qualifications. The MITD must have a training module specifically for Operation and Maintenance of incinerators.

**Recommendation 89:** The creation of a Database in terms of traceability and centralization of information in order to dispose of waste properly is recommended. This measure could be applied to small farmers using of agro chemicals and other hazardous wastes.

In the long term, by 2020:

#### ***Infrastructural recommendations***

**Recommendation 90:** A hazardous and chemical waste regroupement platform for reception, treatment, stabilization, storage and disposal should be set-up.

**Recommendation 91:** All countries and Island States in the Indian Ocean could have a common regional waste treatment facilities for hazardous waste. Feasibility study can be conducted through funds from SADC, COMESA and IOC..

WG3 expressed their recommendations for **medical waste**.

*Legal and Institutional recommendations*

**Recommendation 92:** In line with recommendation #80, all generators of medical waste need to have a health care waste management plan by 2015.

**Recommendation 93:** at the same time, a legal framework for the collection, storage, treatment and disposal of medical waste should be adopted and enforced. This legal framework should include traceability of all products from the source to complete elimination. Generator pays principle should be adopted. Laboratories should be equipped to analyze compatibility of the products that can be exported together. Furthermore, clinics, hospitals and dentists should have a proof or a medical waste disposal certificate of how they are eliminating their waste before renewal of operating licenses.

As regards **pharmaceutical wastes**, it is recommended that by 2015:

**Recommendation 94:** a strong legal framework for pharmaceutical waste is required for importers / producers to take back expired medical products.

Four different types of **special wastes**, namely (1) chemical wastes, (2) Used tyres, (3) E-wastes and (4) Radioactive wastes have been identified and addressed by WG3. The recommendations in that regard are listed below.

**Recommendation 95:** On the issue of **chemical wastes** from printing, photographic industries, clinics and dentists for instance, a proof of how these wastes are eliminated should be required in order to renew operating licenses. This proposal could be implemented by 2015.

**Recommendation 96:** For **obsolete chemical wastes** like pesticides and solvents, training programs exists on how to transport store and dispose such wastes. These training programs should be encouraged and extended by 2015.

**Recommendation 97:** Concerning **Used tyres** , there should be possibilities to break and re-use them in road-bedding by 2020.

**Recommendation 98:** Incentives are needed to retread used tyres.

**Recommendation 99:** Used tyres can be treated in the same system as PET bottles using the same legal framework. In this regard, financing can be achieved from importers with taxes being imposed at source by government.

**Recommendation 100: E-waste is defined as Waste of Electric and Electronic Equipments (WEEE),** . The collection and proper disposal of used fluorescent and energy saving lamps, laboratories equipments waste should be undertaken. By 2015, it is recommended that E-Waste should be banned from landfill and that a scheme for E-waste in general should be implemented for their proper disposal especially considering their mercury content. Part of what has been collected could also be re-used. *Annex: A list of WEEE*

**Recommendation 101:** Extended Producer Responsibility should be shown on bills as transparency principle. Furthermore, only internationally recognized and eco-friendly labels and products should be imported.

**Recommendation 102: Radioactive waste** is under the responsibility of the Radiation Protection Authority. It is recommended that a study on the means for confinement and disposal of such waste be carried out by 2015.

## **11. Environmental health: *reducing health threats on the population***

### **11.1. Overview and gaps**

Humans interact continuously with the environment. These interactions, although known to be complex in nature, do affect health and quality of life. As such, many environmental health hazards have been identified that do significantly impact on human health , either directly or indirectly .Scientific evidence of a causal association between disease occurrence and some of these environmental hazards already exists , while in others such linkages are yet to be established conclusively .

In this context, Environmental health is the field of public health that addresses all the physical , chemical and biological factors in the environment and all the associated factors impacting behaviours.It comprises the assessment , mitigation, control and the prevention of those factors that can impact on health of the present as well as the future generation.

Environmental health is the branch of public health that is concerned with all aspects of the natural and built environment that may affect human health. Other terms that concern or refer to the discipline of environmental health include environmental public health and environmental health and protection.

Environmental health is defined by the World Health Organization as:

*Those aspects of the human health and disease that are determined by factors in the environment. It also refers to the theory and practice of assessing and controlling factors in the environment that can potentially affect health.*

Environmental health as used by the WHO Regional Office for Europe, includes both the direct pathological effects of chemicals, radiation and some biological agents, and the effects (often indirect) on health and wellbeing of the broad physical, psychological, social and cultural environment, which includes housing, urban development, land use and transport.

Environmental health services are defined by the World Health Organization as:

*Those services which implement environmental health policies through monitoring and control activities. They also carry out that role by promoting the improvement of environmental parameters and by encouraging the use of environmentally friendly and healthy technologies and behaviours. They also have a leading role in developing and suggesting new policy areas.*

In Mauritius, environmental health is under the responsibility of the Ministry of Health and Quality of Life. The National Environmental Strategies updated in 2008 aims at maintaining high standards of environmental health and quality of life.

### ***Issues, Challenges and Gaps***

World Health Organisation has estimated that 25% of the total disease burden worldwide are caused by environmental hazards, the impact being more pronounced in children in whom environmental factors contribute to nearly 33 % of the overall disease burden. Diarrhoea, lower respiratory infections, unintentional injuries and mosquito borne diseases contribute largely to this disease burden.

The traditional environmental hazards are air pollution, water, food and soil contamination, disease vectors and occupational health hazards.

The magnitude of environmental related problems and their impacts on the population are not necessarily equal in all countries, with developing nations having to face a higher burden of diseases related to environmental factors. However, in developed nations, Non Communicable Diseases, including cancer, contribute significantly to the overall disease burden.

Most of these environmental factors are modifiable and ,as such, there is now irrefutable evidence that established and cost-effective interventions geared towards the environment can promote healthy living. World Health Organisation has estimated that such interventions can prevent 13 million deaths each year worldwide.

It is now felt that policies needed for dealing with most of the traditional environmental factors, more so pollution related issues, are generally well understood and are being refined and implemented. In recent years, however, a more complex set of environmental challenges has become the focus of attention for scientists and governments worldwide and this includes climate change, biodiversity and the sustainable management of forests, oceans, freshwater and land resources. Moreover, concerns have also been expressed towards the newly emerging issues related to the use of cellular phones.

Mauritius has made quite significant progress in its endeavour to protect public health, more so in respect to some of the traditional environmental problems. Thus, access to safe water supply is nearly universal, while environmental sanitation has improved over the years.

Nevertheless, we are yet to deal in a concise manner with issues related to air, noise and soil pollution and other emerging challenges.

Furthermore, it is felt that establishing linkages between environment and health have yet to become a reality. Human health and environment are still being dealt with as separate entities. In this context, it is felt that there is a need to bridge the knowledge gap in terms of risk and impact assessment as well as develop proper tools in order to prioritize the environmental health problems. Health impact assessment ,using existing methodologies and tools, should now

become part and parcel of any decision-making process. In addition, this process should be fully integrated in the national economic development programme. This will also help to increase awareness of health issues within other sectors by contributing evidence on health benefits and risks

Therefore, WG3 has addressed the issue of environmental health with a series of recommendations to be implemented.

## **11.2. Recommendations**

By 2015, the working group recommends the followings.

***Recommendation 103:*** to include Strategic Environmental Assessment (SEA) within the EPA in all sectors in the MID vision.

***Recommendation 104:*** Epidemiological and health data should be available and accessible to the public.

***Recommendation 105:*** Health Impact Assessment (HIA) should be introduced as a tool encompassing steps and procedures for assessing and reducing the negative health impacts of development projects. HIA can be used as a tool to inform Policy and decision makers so they can maximize the benefits of sustainable development and minimize the negative impacts on the health of the recipient communities. A multi-sectorial committee, involving all major stake holders could be set up to oversee the systematic introduction of HIA in Mauritius.

***Recommendation 106:*** the control and monitoring of the quality of imported foods especially before they reach the consumers should be improved. The Food Import Unit control at port and airport should be strengthened while laboratories should be fully equipped and be up to standards to do all the tests. Improvement of the mechanism for monitoring and enforcement should also be addressed in that regard.

***Recommendation 107:*** The indiscriminate application of pesticides, herbicides and fungicides are dangerously increasing the toxicity of soils and food. Health of farmers can also be affected;. It is therefore proposed to undertake an immediate control and monitoring of highly dangerous “cocktails” of those pesticides being made by farmers.

**Recommendation 108:** The respect of proper clothing and safety measures and equipments by farmers and workers of the local Municipalities and District Councils should be enforced.

**Recommendation 109:** The promotion and training of an Integrated Pest Management System should be monitored by the authorities to bring forward and reinforce the use of predators, parasites and bio-control microbes

**Recommendation 110:** The reduction of pest pressure should be implemented through a proper balanced fertilization of crop. Tailored fertilization programs for different crops should be encouraged.

By 2020, WG3 proposes that:

**Recommendation 111:** an “Observatoire de la Santé” should be created to do research and coordinate and centralize all data related to health.

**Recommendation 112:** a more in-depth analysis for nutrition farming system leading to more nutritious foods should be carried out.

**Recommendation 113:** Through the concept of sustainable agricultural practices with a feasibility and implementation study, WG3 recommends that on the long term the dependency on agro-chemicals for the production of food should be decreased. During consultation on Rodrigues, recommendation to use botanical pesticides (e.g. neem) to substitute to chemical pesticides was proposed. A study on this proposal could also be applied to the whole Republic.

## **12. Embellishment of the environment: *placing people at the centre of development***

### **12.1. Overview and constraints**

Embellishment of the environment was addressed during the meetings of the working group and it was observed that the development of the country should be in harmony with nature. The MID project should take into consideration of how to change the way people live in Mauritius. A well planned concept in that regard should bring all amenities to help people enhance their quality of life and not as it is too much seen to bring more frustration in people’s life. However some projects are being undertaken such as The Green School Project has already been introduced by

MOESD & M/Education in some schools and same is being extended to all school in the Republic of Mauritius. Government is also implementing Eco-Villages concepts / projects in 9 villages

With respect to the proposals of the working group creating a proper living environment should be favored instead of only “embellishing the environment”. The question is to have the Mauritian at the centre of development and there should be pressure on the government to change the legal framework that governs development in Mauritius.

## **12.2. Recommendations and proposals to enhance quality of life**

As regards the issue of embellishment of the environment, WG3 has proposed that by 2015:

**Recommendation 114:** the terminology of “embellishment of the environment” theme should be changed to “creating the right living environment” as this way, the essence of putting the people first is captured better.

**Recommendation 115:** Learning and education should be rendered more attractive with more visits, outings and exhibitions organized regularly. Opportunities should be given and encouraged to practice at home what has been learned.

**Recommendation 116:** Environment clubs should be created at local level such as in community centres, women association, schools, etc. to promote kitchen and roof gardening.

**Recommendation 117:** Each Independence Day should also become a “Plant a flower / Endemic Plant day”. In the same line of thought, all environmental events such as the World Environment Day, Earth Day, Clean up the World Day etc. should be promoted and celebrated at national level.

**Recommendation 118:** an appeal to stop cutting pine tree or Araucarias as Christmas trees was made. Instead people can consider buying artificial plastic tree for Christmas which can be used and re-used and last for years.

**Recommendation 119:** Beautification contests at local authority level could be organized regularly to identify and reward beautiful buildings which could for instance be put on postcards or other promotional frames.

***Legal and institutional recommendations***

**Recommendation 120:** the protection of wetlands exists through the Ramsar Convention and the NPCCS, but there is a need for more enforcement to prevent backfilling of these wetlands. The Wetlands Bill should urgently be enacted in this regard. Moreover, data on the location of wetlands should be disseminated. This proposal is recommended to be applied to the whole Republic.

**Recommendation 121:** Although legislation exists, “Syndic” in all high-rise buildings and apartment blocks should be enforced.

**Recommendation 122:** Environmental stewardship should be encouraged and promoted. For instance, community involvement should be made in a structured manner such as “comité de quartier” could help in building a feeling of ownership in the proper maintenance and uprising of residential areas.

**Recommendation 123:** The National Network for Sustainable Development (NNSD) should be reinforced to review community projects from NGOs and civil society.

**Recommendation 124:**Community Development Centres should be set up in a transparent manner in order to function properly.

**Recommendation 125:** Sources of funding for potential “embellishment” projects and fundable projects could be published through MID website.

**Recommendation 126:** Guidelines for promoters should be developed, compiled and made accessible.

In the medium term, by 2020, it is recommended that:

**Recommendation 127:** Embellishment or “how to create the right living environment” aspects should be introduced in school curriculum. This could be implemented by the concept of learning by doing. Practicing is necessary, for instance gardening, planting, school nursery require both theory and experience. Audio-visual aids and all sorts of educational tools such as

cartoons should be made available in a user-friendly way. Furthermore, a sense of environmental aesthetics needs to be inculcated.

### ***Infrastructural recommendations***

***Recommendation 128:*** a Master Plan for the main roads and arteries should be implemented. Some and parts of streets should be pedestrian only. Pavements should be provided on all roads where possible. Appropriate trees, shrubs, flowers along the roads (with regular maintenance) should be planted. Pedestrian should also respect what it is provided by authorities such pedestrian crossing. Parking on beaches should be banned.

***Recommendation 129:*** Authorities should conduct surveys and make allowance for sufficient road reserves to allow for bicycle/walking lanes, and proactively enlarge roads where land is still available.

***Recommendation 130:*** Trees should be planted around major development projects, for example shopping malls. Legislation should be reviewed in that regard to have private promoters to “green” the space.

***Recommendation 131:*** Possibility of considering one-way streets where possible so that more space is available for planting trees should be studied.

***Recommendation 132:*** Humps and speed breakers on roads should eliminated and other systems than roundabouts should be thought about to slow down traffic.

***Recommendation 133:*** An integrated approach in the design of low-cost housing should be adopted. Housing should integrate a concept associated with the existing natural environment. Maintenance should also be done in the long term.

***Recommendation 134:*** As regards to habitat, housing type and architecture, an appeal was made to stop construction eye-sore done without control and legislation. There’s a necessity to educate people whereas at the same time implementation of existing laws is not being done and this should be the role of the state. Therefore, the town and country planning Act should be updated to include architectural standards and guidelines on aesthetics and design for construction.

***Recommendation 135:*** to enhance the aesthetic view of landscapes billboards installed along roads, main roads and motorway should be restricted to urban areas.

### ***Economic recommendation***

**Recommendation 136:** A National policy on how to use properly loan money for construction should be created as often money received is not enough to finish a house. A counseling and advice service to borrowers should be given and it would have to be the bankers responsibility to prepare people to use their money efficiently when building a house in the context of MID guidelines.

In the long term, WG3 expressed their proposals that:

**Recommendation 137:** Projects such as the environmental socio-economic project at la Gaulette and Le Morne under the ICZM / Recomap should be replicated in other region. These projects could start in the short term and remain ongoing.

### **13. Conclusion**

In general, the working group expressed many recommendations but as a very brief summary of the tone of the discussion during consultation, it appears that many laws and legislation exist in Mauritius, but enforcement and compliance is deficient.

A target has to be set to reinforce existing laws, implement fines for those not respecting laws, identify and prioritize key areas for intervention. Changes are needed. The problem of environment is complex and cannot be dealt alone. Poverty is a key element to the environment problem. The answer was an integrating approach to pursue development but economic growth should not be the only target. Solution will come from implementation by Government with a joint partnership with all other stakeholders, including private sector, NGOs and civil society.

Furthermore education is the one way to change; sensitization and awareness campaigns should be carried out constantly.

Moreover, it was added that pollution problems should also be tackled at the source. Integrated plans for sustained waste management should be a priority target following all recommendations expressed by the working group. Environmental Health brings up issues such as quality of life, food, water and air. There is an urgent need to apply and enforce existing laws while exploring other possibilities to enhance quality of life of citizens

However, it has been noted that the working group was doubtful about the outcome of the MID project in implementing fully all the recommendations. Examples of existing laws and legislative frameworks in the sector of environment not being implemented have been cited in that regard.

The involvement of decision makers at the highest level would be crucial in ensuring the success of the recommendations made by the various working groups.

## **14. Annexes**

### **Annex 1: Base paper**

#### **Working Group 3 : Environment Base paper (DRAFT)**

##### **Introduction**

*This Base Paper is a brief summary of the different focal areas of Intervention the Working Group 3 on Environment for Maurice Ile Durable concertation phase; The areas of intervention depicted in this document are namely Air Quality, Noise, Solid Waste, Waste Water, land Planning and Landscaping. This list is not exhaustive but aims at giving a broad spectrum of the situation of these elements in Mauritius. It is also essential to note that no particular topic deals here with Environmental Health as such since most of the themes presented here can be considered as sub-themes in this regard.*

*An overview of legal framework and institutional framework governing these topics is presented along with a present day status to point out the gaps and problems pertaining to each of them and therefore raise some points for discussion and concertation.*

## Air Quality

### 1. Legal Framework

Environment Protection (Standards for Air) Regulations 1998.  
Road Traffic (Control of Vehicle Emissions) Regulations 2002.

### 2. Institutional Framework

The National Environmental Laboratory (NEL) of the Department of Environment is responsible for the ambient air monitoring. At present, NEL is equipped with 3 mobile stations; one Particulate Matter Analyser (PM2.5, PM10 and TSP) – mostly for use near stone crushers; one gaseous analyser – analysis of SO<sub>2</sub>, NO<sub>x</sub>, CO – mostly for use at hotspots; and a newly acquired mobile station still under commissioning for analysis of SO<sub>2</sub>, NO<sub>x</sub>, CO, PM 2.5, PM 10 and TSP. The mobile stations are regularly displaced to sites where high pollution levels are suspected (hotspots). The automatic analysers and equipment at the stations measure the concentrations of major pollutants such as sulphur dioxide, oxides of nitrogen, carbon monoxide, ozone, particulate lead and respirable suspended particles (PM10).

National Transport Authority and Police de L'Environnement are also enforcing bodies in terms of Air Quality, air pollution and emissions.

### 3. Status

The Ministry of Environment has got three ambient air quality monitoring station. The following measures are adopted by the MoE in controlling air pollution :

- minimising emissions at source; and
- minimising the impact of residual pollution on surrounding developments by proper siting of industries
- monitoring of ambient air at suspected sites

Total emissions and removals of greenhouse gases of which carbon dioxide (CO<sub>2</sub>) constituted 95%. The data indicate a marginal rise in net CO<sub>2</sub> emissions from 1,517.1 thousand tonnes in 1995 to 2,572 thousand tonnes in 2004. Net emissions take into account the removal of CO<sub>2</sub> by forests which act as 'sinks'.

### 4. Gaps / problems

The main sources of air pollution in Mauritius are from the burning of fossil fuel for heat generation in industries, electricity generation and transportation.

The sources of air pollution can be grouped into three categories as follows:

- stationary sources such as power stations and industries (e.g. stone crushing plants);
- mobile sources such as motor vehicles; and

- others such as open burning of waste materials and burning of sugar-cane fields
- Other sources are emissions from incinerators, boilers, thermal etc

Question: How are these main sources of air pollution in Mauritius monitored and what are the measures being taken to minimize their effect on air quality?

Publication and dissemination of Air quality indexes is inadequate as there is no AQI reporting.

No stack monitoring is being carried out on a regular basis. In the Regulations, both ambient and stack emissions are available. Only University of Mauritius has the facility. Fixed stations are not available; therefore there is no continuous monitoring of the air quality.

## 5. Way forward

Point for discussions:

*How to address the problem of Air pollution? What action to take?*

*Possible studies to be undertaken on namely Vehicule emission, health impact of air pollution, impact and deposit on foodcrops, etc.*

## Noise

### 1. Legal Framework

- Environment Protection Act 2002 amended in 2008– (Standards for Noise Regulations);
- Environment Protection (Control of Noise) Regulations-2008.
- The provision under the Environment Protection (Control of Noise) Regulations takes on board inconveniences arising from recreational noise, music played in a loud tone, parties, disco, shriek, shout and use of loudspeakers etc.
- 

### 2. Institutional Framework

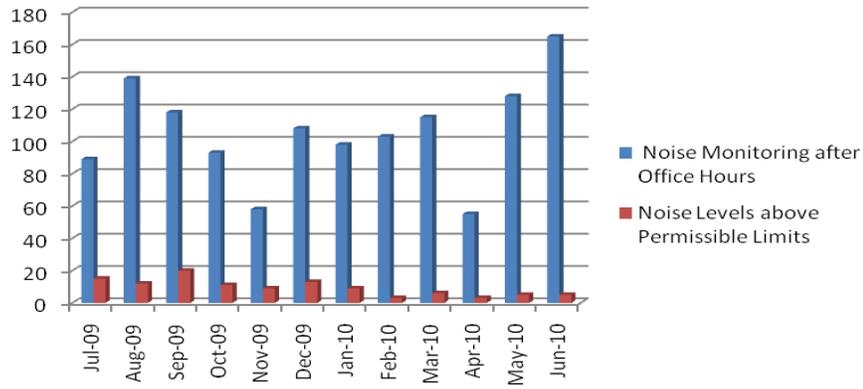
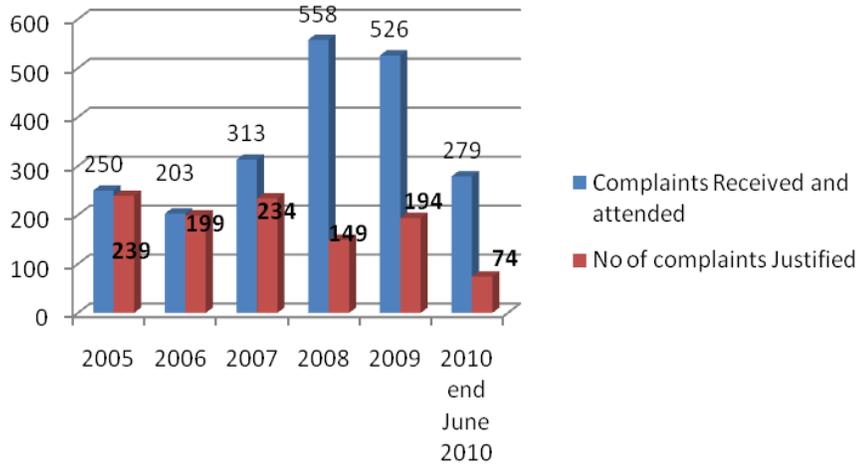
- To ensure compliance with the Environmental Regulations, officers of the Environmental Health Engineering Unit are equipped with five sound level meters.
- Officers of the Environmental Health Engineering Unit attend to all noise complaints received as per established protocol
- Where it is ascertained that there is noise pollution, a warning is issued followed by a Programme Notice, Enforcement Notice and Prohibition Notice where required as per provisions of the Act in case the noise pollution persists.
- In view of increasing number of noise complaints the Environmental Health Engineering Unit has set up of a Flying Squad to attend to noise complaints after office hours and during weekends.

### 3. Status

In Mauritius, noise is presently the most common environmental problem, as on the average during the last several years, about 30% of total complaints registered at the Department of Environment and the Ministry of Health and Quality of life, are related to noise pollution problems. The main sources of noise pollution in Mauritius are from:

<i>Industrial sector</i>	<i>Multipurpose halls</i>	
<i>Bungalows</i>	<i>Places of entertainment</i>	
<i>Small and medium enterprises</i>	<i>Domestic sector</i>	<i>Animals</i>
<i>Traffic</i>	<i>Aircrafts</i>	<i>Power plants</i>
<i>Musical concerts</i>	<i>Religious activities</i>	<i>Alarm system</i>
<i>Workshops (cabinet making, panel beating, metal, aluminium)</i>		

Very often, the sources are found within residential areas and these directly affect the quality of life of the citizens.



Noise Exposure limits :

Industrial Noise

07 00---21 00 hrs --- 60 dB

21 00---0700 hrs --- 55 dB

Neighbourhood Noise

07 00---18 00 hrs --- 60 dB

18 00---21 00 hrs --- 55 dB

21 00---07 00 hrs --- 50 dB

Power Station Noise

In residential area –

07 00---21 00 hrs --- 60dB  
21 00---07 00 hrs --- 55dB

In any other area  
At any time --- 70dB

#### 4. Gaps

In Mauritius, due to the fact that land is scarce, the problem is magnified. Under the Environment Protection (Control of Noise) Regulations, enforcement is based only on the subjective effects of noise, or of the corresponding reactions of annoyance and dissatisfaction and does not rely on sound level measurements.

It may be perceived that remedial action as regard noise pollution has been slow and reactive instead of being proactive. The priority is more on business facilitation for promoting job creation.

- Safety: taking enforcement measures when a party or recreational activity is in full swing involve certain risks
- Proximity and availability: one- off events are usually of limited duration. Intervening in the shortest delay is quite difficult
- Recurring and unjustified complaints placing strain on time and resources .
- Environment Noise Assessment and Monitoring is lacking.

#### 5. Way forward

Points for discussion:

Proper consideration should be given to planning in respect of proposed developments and their likely impact on surroundings;

Renewal of permits and licences for polluting activities or activities having caused nuisances in the past including Night Clubs and Discotheques be subject to conditions that appropriate measures have been taken to eliminate factors causing the said nuisances.

- *Zoning atlas/maps for siting of industries*  
In order to delineate the areas that are suitable for industrial siting, a local land use zoning Atlas could be undertaken under the aegis of the Local Authority. The industrial zones can be identified based on the sensitivity and pollution-receiving potential of the site. Data obtained from environmental auditing can be useful in determining the pollution loads generated in specific areas. The Atlas can also be used to demarcate land for the clustering of SMEs.
- *Promotion of pollution control*  
Industries can be encouraged to adopt pollution prevention technologies to reduce and control noise emission;
- *Strengthening enforcement capacity*  
To control community noise and road traffic noise; and
- *Public awareness*

- To encourage the public to comply with noise regulations.
- *Capacity Building of technicians to carry out Noise Survey (Diploma at the UoM)*

## Solid Waste

### 1. Legal Framework

Solid waste collection is undertaken by the local authorities in areas under their jurisdiction.

The various functions and responsibilities of the Solid Waste Management Division are governed by the following legislations:

- Local Government Act 1988 and 2003
- Environment Protection (Standards for Hazardous Wastes) Regulations 2001
- Local Government (Dumping and Waste Carriers) Regulations 2003
- Local Government (Registration of Scavenging Contractors) Regulations 2004
- Environment Protection (Collection, Storage, Treatment, Use and Disposal of Waste Oil) Regulations 2006

### 2. Institutional Framework

Solid Waste Management Division of the Ministry of Local Government and Outer Islands.  
Local Authorities (Municipal Council and District Council)

### 3. Status

With the growth in population, employment and economic activity and the increase in consumer spending power, the amount of waste generated is on the increase. A total of 1,200 tonnes of wastes is estimated to be generated daily in Mauritius for a total population of around 1,245,000 (2010). Municipal Solid Waste (MSW) generated in Mauritius consists mostly of organic wastes, namely yard and domestic wastes, representing around 70% of the total generation. Each Mauritian generates around 0.7 kg of solid waste daily and around 427,800 tonnes of solid wastes were disposed of at the Mare Chicose landfill in 2010.

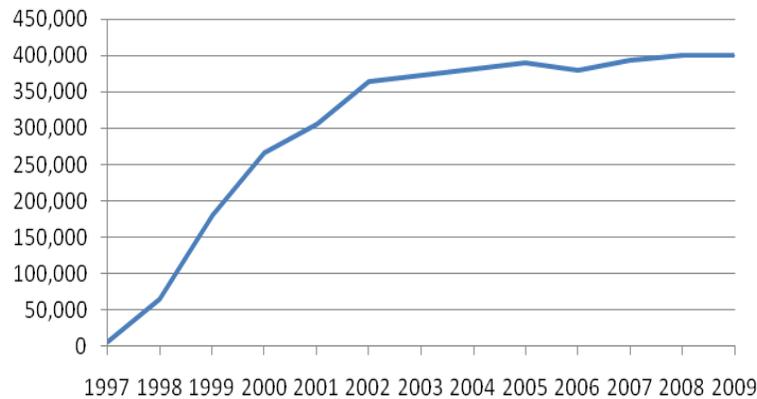
Domestic waste in Mauritius consists of 60 - 70% of biodegradable matter. Composting these materials would convert organic material into compost that can be applied to land to increase soil fertility. Composting is part of the national strategy for waste minimization therefore, construction of a Pilot Green Composting Plant has been undertaken.

Solid waste collection is undertaken by the local authorities in areas under their jurisdiction and disposed of at the Mare Chicose landfill via a network of transfer stations situated at St Martin, Roche Bois, Poudre d'Or, La Brasserie and La Laura.

Components	Composition, %
Kitchen waste	45
Yard waste	25
Paper	10
Plastics	9

Textile	4
Glass	3
Metal	2
Other	2

*Composition of Solid Waste in Mauritius*



*Waste landfilled at Mare Chicose from 1997 to 2009 (Tonnes)*

#### 4. Gaps

- Increase of the amount of solid waste generated and new facilities for disposal will have to be provided.
- Inefficiencies in waste collection due to the lack of adequate number and type of waste collection vehicles, personnel and proper supervision
- Limited waste reduction, reuse, and recycling - there are no comprehensive legal and economic instruments in place to sustain waste reduction, reuse and recycling. Infrastructure/facilities for separate collection and transport are also limited.
- Limited institutional capacity at the central and local levels to address solid waste issues effectively
- Inadequate enforcement of laws and regulations governing solid waste management aspects
- Lack of database on solid waste management
- No dedicated hazardous waste disposal facility
- Limited information /education and awareness
- Limited financing and absence of cost recovery
- Littering and illegal dumping
- Lack of education and awareness

#### 5. Way forward

The development of an integrated solid waste management strategy is among the priorities identified in the National Environmental Strategies to reduce future costs from environment degradation. Government's policy is to promote waste reduction, minimise its generation, encourage the adoption of environmentally sound methods of resource recovery and modernise the institutional and legal framework for the entire logistical chain – collection, storage, transfer and disposal – and introduce a cost recovery mechanism.

Some points for discussion:

- *To render waste collection more effective and efficient* with the objective of a better service and a lower 'per ton' cost

- *Recycling*

Government wants to encourage waste recycling by encouraging recycling industries and by changing consumption behaviour; for example with regards to PET bottles, Government has promulgated the Environment Protection (Polyethylene Terephthalate (PET)) Bottle permit 2001 regulations to develop "product responsibility" among bottlers for the proper management of used bottles.

- *Awareness Campaign*
- *Energy Recovery from Mare Chicose Landfill Site.*
- *To recognize that certain waste streams have economic value (resource)* and to deviate these wastes from the conventional channel that end up in their disposal
- *To reduce the overall public expenditure on solid waste management* on the basis of (i) economic value of certain waste streams and (ii) payment of fees by businesses and householders.
- *To set up a structure system* for receiving, treating and/or exportation of hazardous wastes which will be sustained by fees from generators
- *Reform of the Institutional and Legal Framework*
- *Occupational Hazard of the scavenging services*
- *Alternative waste treatment technology*
- *Treatment of new type of waste (i.e. electronic)*
- *Treatment of other types (i.e. medical, animal)*

## Waste Water

### 1. Legal Framework

Wastewater Management Authority (WMA) Act 2000,  
Under the WMA Act 2000, no person can discharge or cause to be discharged effluent into the public sewer unless he holds a valid license from the WMA. In addition, the quality of industrial effluent requires to meet the Standards for Discharge of Industrial Effluents into Sewers, GN. No. 182 of 2004. The scheduled list of activities that requires a license for discharge into the public sewer and requires compliance monitoring have been defined in the Wastewater Regulations 2004.

It is to be noted that the Ministry of Energy & Public Utilities (MEPU) is the enforcing agency for environmental legislation related to inland waters and discharge of effluents into the environment. The following legislation is of relevance to the wastewater sector.

- Environmental Protection Act 2002
- Environment Protection – Standards for Effluent Discharge into Ocean (Regulations 2003)
- Environment Protection – Standards for Effluent Discharge onto Land/Underground (Regulations 2003)
- Environment Protection – Standards for Effluent Discharge into Surface Water Courses (Regulations 2003)
- Environment Protection – Standards of Effluent for Use in Irrigation (Regulations 2003)
- Environment Protection – Effluent Limitations for the Sugar Industry (Regulations 1997)
- Public Health act (2008)
- Local Government Act (2003)

### 2. Institutional Framework

#### *The Wastewater Management Authority (WMA)*

The Authority operates under two (2) legal instruments, signed on August 31, 2001, which regulate the relationship between the WMA and the Ministry of Energy and Public Utilities. These are the "Convention de Maîtrise d'Ouvrage Déléguée (CMOD) for construction of new works and "Contrat de Délégation (CDD) for the Operation & Maintenance of the Public Wastewater Systems. The main objectives of the WMA are to

- Contribute to the sustainable preservation of the fragile environment and of the fresh and coastal waters of Mauritius.
- Halt and reverse the trend of wastewater pollution on the island and its coastal zones
- Improve the sanitary conditions of the population and protect public health.
- Provide a reliable and high quality wastewater service in Mauritius.
- Forge a strong partnership with all stakeholders sensitive to the cause of the environment.

The WMA is responsible for connecting domestic, commercial and industrial premises to the wastewater sewer networks.

### 3. Status

Main sources of water pollution in Mauritius are industrial effluent.

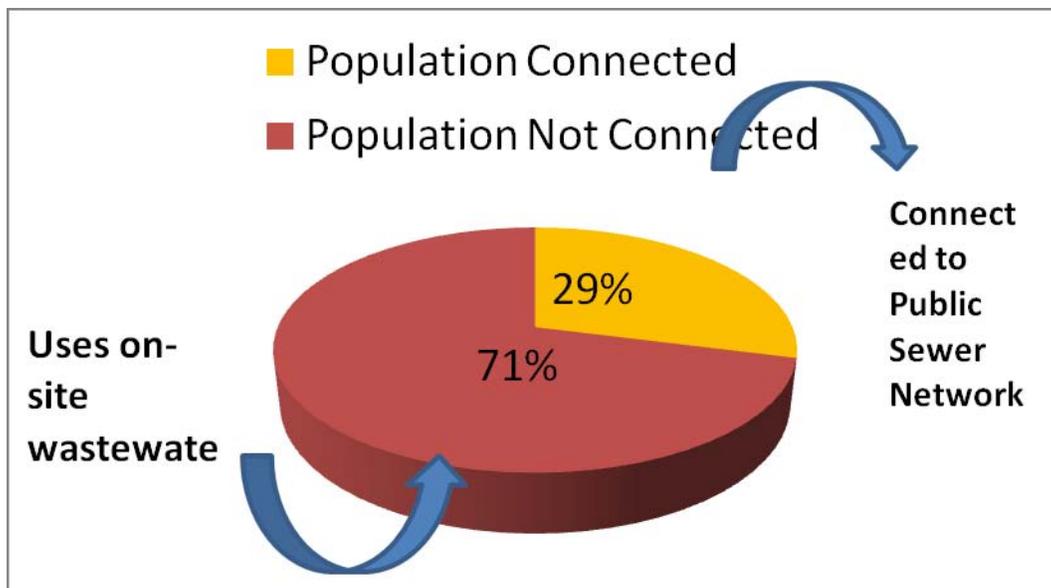
There are some commercial farms in certain areas.

In addition, solid and/or liquid wastes, if not properly managed and disposed of, will also cause water pollution.

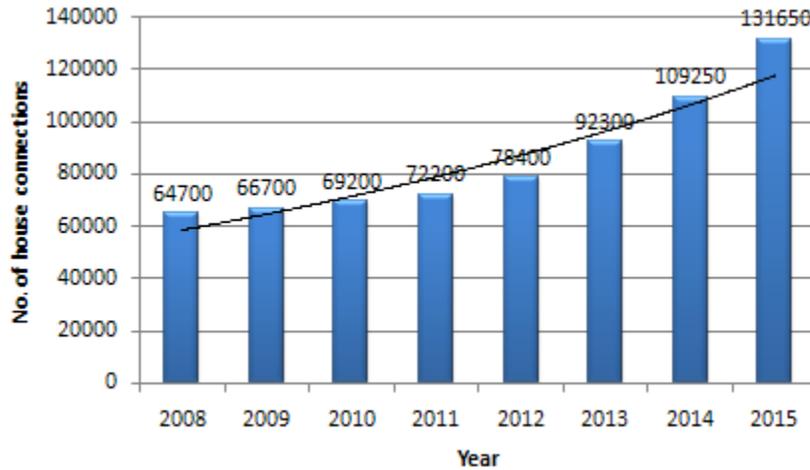
The following measures are adopted in Mauritius for controlling water pollution:

- providing sewerage infrastructure and solid waste management system to prevent pollution at source;
- requiring industries to pre-treat their effluent to prescribed standards before discharge into the sewerage system;
- and
- prohibiting industries which use or store large quantities of chemicals to be sited within water catchments.

In 2010, some 93,000 m<sup>3</sup> of wastewater was captured and treated daily; it is expected that with the increase in house connection in the near future, this volume will further shoot up and reach an estimated volume of 179,000 m<sup>3</sup> daily by the year 2015.



*% connection to the public sewer system*



*No. of house connections for the timeframe 2008-2015*



*Volume of wastewater (m³/day) treated/to be treated*

#### 4. Gaps

Treatment plants treat wastewater up to the secondary level only using the activated sludge process. As compared to the major Wastewater Treatment Plants namely St Martin, Grand Baie, Mt Jacquot and Baie du Tombeau which receives a considerable flow of wastewater, the CHA Estate WWTPs are minor treatment plants receiving an average volume of only 150m<sup>3</sup> wastewater per day. The following is a list of potential constraints that are usually encountered during the implementation phase of capital sewerage projects.

- It is no easy task to obtain wayleaves from Municipalities, Road Development Authority (RDA) and District Councils among other institutions prior to starting works.
- It is a lengthy process to obtain authorization and permission from ministerial and other organisations for undertaking of sewerage works.

- Land acquisition for construction of sewerage infrastructure is a complex and lengthy process.
- There is a nuisance factor during the implementation of sewerage projects such as dust and noise pollution, traffic diversion, loss or relocation of businesses, difficulty to access sites/premises...etc.
- Many underground services (for instance CWA pipes) are not clearly defined; this represents an issue of concern especially during excavation works and laying of sewer pipes.
- Delays are at times encountered due to challenges and court appeals especially during the tendering process.

The above constraints usually lead to delays in project implementation thereby incurring extension in timeframe and at times additional costs. Furthermore there is no public wastewater collection and treatment system as such in Rodrigues. The inhabitants make use of on-site wastewater disposal systems such as pit latrines and septic tanks followed by absorption pits or cesspits. Flush systems exist mainly in the capital Port Mathurin where there is potable piped water supply.

## 5. Way forward

Point for discussions:

- *National Sewerage Projects*
- *Monitoring of effluent quality*
- *Operation and maintenance of the sewer networks and Wastewater Treatment Plants (WWTPs)*
- *Pollution Control Unit (PCU)*

## Land planning / Landscaping

### 1. Legal Framework

National Physical Development Plan (NPDP – developed in 1994 and updated in 2003); the Tirvengadam Report; the Sugar Industry Efficiency (SIE) Act of 1988, 1998 and 2002; the Finance Act of 1994; the Environmental Protection Act (EPA), the “Morcellement” Act as well as the Municipal and District Council Regulations, the Zoning Committee of the Ministry of Housing and Lands, and the Sugar Productivity and Efficiency Unit of the MoAF. Planning Policy Guidance, Mauritius, Ministry of Housing and Lands (2004, revised in 2006).

### 2. Institutional Framework

Planning related to land use in Mauritius is mainly carried out by the Ministry of Housing and Lands and executed by the local authorities (presently, there are 5 municipalities and 4 district councils). Following the entry into force of the new Local Authorities Act 2003, Mauritius is being sub-divided into 12 municipalities with greater autonomy than previously accorded. Powers will be conferred on the councils to ensure better management and control of local development. The Government has approved the Town and Country Planning Bill (2004), and this has facilitated the granting of development permits. The MoE&NDU enforces good land stewardship through the Environment Impact Assessment Act. The Ministry of Environment and National Development Unit (MoE&NDU) issues EIA licenses for major development projects.

### 3. Status

In 2002, Government commissioned the National Development Strategy (NDS) for Mauritius and Rodrigues, following a review of the NPDP. The NDS has already been completed and approved by the government in early 2003 and a high level committee has been established to follow up implementation of the recommendations. The NDS has identified a number of gaps in the development framework, which have bearing on the processes underpinning land degradation. With regard to the environment, the NDS has identified the following strategic priorities, to underpin sustainable development interventions:

- To safeguard valued elements of the natural and built environments;
- To use natural resources in a sensitive and sustainable manner;
- To promote land and property development and management practices which will benefit the environment, and
- To ensure that development makes a positive contribution to the environment.

The NDS also provides summary policy guidance for the agricultural and forestry sectors. Key guidance related to agricultural lands cover include; a) the need to zone high quality agricultural land so that it cannot be developed; b) review of farming practices, agricultural diversification in line with the recommendations made under the Non- Sugar Sector Strategic Plan for Mauritius; c) monitoring the long term effects of the sustained use of pesticides and fertilizers in the agriculture sector including on water quality and human health, and; d) promotion of organic farming.

The government is also placing a high emphasis on land management through the implementation of the recommendations made under the National Environmental Strategies (NES) and the second Environment Investment Program (EIP II). A range of issues was identified as demanding immediate attention, including the identification and delineation of Environmentally Sensitive Areas (ESAs).

Three programs that are presently underway which will directly influence sustainable land planning policies, are the compilation of a basic Environmental Information System (EIS), studies to identify

and quantify ESAs and the establishment of an Integrated Coastal Zone Management (ICZM) mechanism and Plan. The National Development Unit is given the responsibility of providing infrastructure in the rural areas, in addition to other Government Ministries and the Local Authorities.

In 2002, the Government of Mauritius voted the Rodrigues Regional Assembly (RRA) Bill to provide more political and economic autonomy to Rodrigues and to allow Rodriguans to chart out their own sustainable development priorities. Capacity building needs as regards the formulation and implementation of decentralized policies and programs and greater coordination with mainland policies shall be an area of particular interest for sustainable land management. Specificities regarding the tenure systems in Rodrigues shall also be taken into account.

At the global level, Mauritius has also signed and ratified a number of conventions, which are of relevance to sustainable land management.

#### **4. Gaps**

In a Small Island Developing State, land is obviously precious and land use planning must aim to optimise the value and uses of land. The statement was made that Mauritius must aim to use each and every metre of its land to its best advantage. One should not be allowed 'to build anywhere'; instead elements such as biodiversity, landscape, heritage etc. should be considered. Appropriate legislation / guidelines should be developed in order to promote such kind of construction.

*Housing and land-use planning:* The Ministry of Housing & Lands (MHL) is constitutionally vested with the responsibility for the formulation of strategies and policies in regard to housing and land development at all spatial levels.

All of the four main direct causes of land degradation – overgrazing, unsustainable agriculture, Deforestation, unplanned construction – are found on the two islands of Rodrigues and Mauritius.

#### **5. Way forward**

Points for Discussions:

Issues and challenges in the Environment Sector on a small Island like Mauritius and likewise Rodrigues are intrinsically related to each other. An integrated effort is required in all sectors to achieve the proper implementation of a Sustainable Land Management programme. Listed below a number of points for discussion:

*Providing Adequate Shelter for All*

*Improving Human Settlement Management*

*Promoting Sustainable Land-Use Planning and Management*

*Promoting the Integrated Provision of Environmental Infrastructure: water, sanitation, drainage and solid waste management*

*Promoting Sustainable Energy and Transport Systems in Human Settlements*

*Promoting Human Settlement Planning and Management in Disaster-Prone Areas*

*Promoting Sustainable Construction standards*

*Promoting Human Resource Development and Capacity-Building for Human Settlement*

*Development*

*Promoting creation of Green Areas / Green Belts within human Settlement Development*

*Promoting embellishment of Landscape*

#### Sources

Ministry of Environment and NDU, *Pocket book of Environmental Statistics* (2006)

Ministry of Environment and NDU, *Fact sheets* (2006)

Ministry of Environment and Sustainable Development, *Mauritius Environment Outlook Report* (2011)

Ministry of Environment and Sustainable Development, *MID Green paper*, (2011)

C.Ciceron, Ministry of Health and Quality of Life, *Enforcement of Environmental Laws* (2006)

S. Jauffur, Wastewater Management Authority, *The Wastewater Sector – Base Paper – MID* (2011)

GOM, UNDP, GEF, FAO, *Capacity Building for Sustainable Land Management in Mauritius (including Rodrigues)*

*BRIEF ON SOLID WASTE MANAGEMENT IN MAURITIUS*

Ministry of Environment and Sustainable Development, *Technical Advisory Committee Report on Noise* (2011)

UNHabitat, *Human Settlement Report* (2004)

*Brief on Environmental Health*

## Annex 2

### Brief on Environmental Health

Human health and environmental quality are closely linked. Environmental pollution and other aspects of poor environmental quality have well-established effects on human health and the quality of life.

Indoor and outdoor air pollution, hazardous chemicals, noise, food and water contaminants are all major causes of the environment-related burden of disease. Cancer, respiratory diseases, allergies and asthma cardiovascular disease, neurological effects, and different reproductive and developmental disorders are examples of health outcomes associated with environmental factors .Major sources of air pollution are the transport and energy sectors for outdoor air, and the housing environment (ventilation, construction materials, humidity, mould mites, and dust) for indoor air. Sources of chemical pollution include industrial activities, households, agriculture, waste disposal and incineration.

Environmental hazards are responsible for as much as a quarter of the total burden of disease world-wide, and more than one-third of the burden among children. Heading that list are diarrhea, lower respiratory infections, various forms of unintentional injuries and malaria. The disease burden is much higher in the developing world, although in the case of certain non-communicable diseases, such as cardiovascular diseases and cancers, the per capita disease burden is larger in developed countries. Worldwide, as many as 13 million deaths could be prevented every year by making our environments healthier. Main factors affecting human health are listed below

1. Physical hazards – droughts, floods, heat, radiation, noise, electromagnetic fields.
2. Chemicals hazards (Occupational and Environmental) –Persistent Organic Pollutants, particulate and non particulate emissions, heavy metals, pesticides etc. which may affect different media (soil, water, air).
3. Biological hazards- bacterial, viral and fungal proliferation responsible for different disease outcomes.

Pollution may affect the above mentioned media (air, soil, water)

## **Air Pollution**

The air we breathe contains emissions from motor vehicles, industry, heating and commercial sources, as well as tobacco smoke and household fuels. Air pollution harms human health, particularly in those already vulnerable because of their age or existing health problems.

Evidence shows that air pollution at current levels in European cities is responsible for a significant burden of deaths, hospital admissions and exacerbation of symptoms, especially for cardiorespiratory disease. Exposure to air pollutants is largely beyond individuals' control and requires action by public authorities at the national, regional and even international levels.

While the hazardous properties of many common pollutants are still under intensive research, evidence-based policies demonstrate that health protection is possible and effective. For example, phasing out leaded petrol decreases blood lead levels in children and reduces their risk for impaired neurobehavioural development. Controlling air pollution, both indoor and outdoor, can significantly prevent diseases.

WHO has defined clear air quality guidelines for indoor and outdoor air quality for different pollutants (e.g. Ozone) in the atmosphere based on models from different countries. Each country including Mauritius has to find ways to maintain ambient air quality and to prevent persistence of certain chemicals.

## **Water and sanitation**

The quantity and quality of the water that we drink is directly linked to health. If the water is contaminated with germs or chemicals, health will be affected. Outbreaks of diseases transmitted by water have a major impact on human health. Examples of diseases which can be transmitted by water include cholera, typhoid, hepatitis and many diarrhoeal diseases. All of these diseases can also be spread by other means, but the quality of public water supplies is particularly important because such supplies are capable of transmitting contaminated water to many people.

### **Excreta disposal**

Human excreta always contain large numbers of germs, some of which may cause diarrhoea. When people become infected with diseases such as cholera, typhoid and hepatitis A, their excreta will contain large amounts of the germs which cause the disease. When people defecate in the open, flies will feed on the excreta and can carry small amounts of the excreta away on their bodies and feet. When they touch food, the excreta and the germs in the excreta are passed onto the food, which may later be eaten by another person. Some germs can grow on food and in a few hours their numbers can increase very quickly. Where there are germs there is always a risk of disease.

### Water Pollution

Water quality guidelines include acceptable limits for different chemicals like (ADI), Acceptable Daily Intake of a chemical from the medium, (PTWI) Probable Tolerable Weekly Intake etc. Analysis of water quality for biological and chemical agents is an ongoing process to ensure safe water supply and sanitation.

### Soil Pollution

Pollution of the soil has direct implications on food safety

1. Chemical- Arsenic, DDT, pesticides
2. Biological- bacteria, viruses, fungi.

Chemical and Biological pollution through the soil can affect different organ systems, causing cardiac, genetic, neurological, hematological damage as well as cancer.

Periodic analysis of soil samples would indicate the level of contamination.

### Noise Pollution.

Excessive noise seriously harms human health and interferes with people's daily activities at school, at work, at home and during leisure time. It can disturb sleep, cause cardiovascular and psychophysiological effects, reduce performance and provoke annoyance responses and changes in social behaviour.

Traffic noise alone is harming the health of many

### Housing and Health

Housing conditions influence people's health in positive and negative ways.

In some European countries, accidents in the home kill more people than do road accidents. Poor design or construction of homes is the cause of many of these accidents.

Indoor pollutants or mould cause asthma, allergies or respiratory diseases, which might be prevented by the use of proper building materials and construction.

### **Climate change and Health**

#### **Health effects of climate change can be direct or indirect.**

##### **Direct effects are:**

1. Effects due to extremes of temperature- cold spells and Heat waves, the latter being more commonly felt.
2. Health effects of pollution and ground level ozone.
3. Deaths and injuries due to storms, floods, droughts, tsunamis and tidal waves.
4. Effects of increased Ultra violet Irradiation caused by depletion of protective ozone layer.

##### **Among the indirect effects we may have the following:**

1. Increased vector borne diseases
2. Increased food and water borne diseases
3. Increase in allergic manifestations

##### **Effects due to extremes of temperature**

- Increase in respiratory and cardiovascular illnesses
- Increased occupational Health risks
- Heat waves can cause conditions such as heat stroke, heat exhaustion, heat cramps and heat rash.

##### **Health effects of pollution and ground level ozone**

- Changed exposure to outdoor and indoor air pollutants and allergens
- Increase in asthma and other respiratory diseases
- Increase in heart attacks, strokes and other cardiovascular diseases
- Increase in risk of cancer.

Extremes of weather leading to storms, floods tidal waves, tsunamis not only bring about deaths and injuries but can also cause mental stress and displacement of population which can in turn increase the risk of disease

### **Effects of increased Ultra violet Irradiation caused by depletion of protective ozone layer**

- Skin damage and skin cancer
- Cataracts
- Disturbed immune function

### **Increased vector borne diseases**

Temperature can modify the growth of disease carrying vectors by altering their biting rates as well as affect vector population dynamics and alter the rate at which they come into contact with humans.

A shift in temperature regime can also alter the length of the transmission season.

Changes in geographical distribution of vectors have also been observed.

Increased rain may increase larval habitat and vector population size by creating new habitats.

#### **Effects on vertebrate host.-rodents**

Increased rain can increase vegetation, food availability and population size.

Increased rain can cause flooding, thus causing decreases in population size. However this can increase human contact.

Diseases transmitted include plague and leptospirosis .

#### **Increased food and water borne diseases**

An increase in temperature causes more occurrence/survival of

bacteria, toxic algae, and other contamination in food and water.

Also, climate change is already reducing the amount of high quality freshwater and this situation is expected to worsen. People will be forced to use poorer quality water sources, leading to increased disease.

The major pathogens that cause acute gastroenteritis multiply faster in warmer conditions.

Climate change is predicted to cause more extreme flooding and storms, which are known to lead to contaminated water supplies. Heavy rainfall can cause sewer/ storm water systems to overflow, releasing raw (untreated) sewerage in local water sources.

Increasing temperature may lengthen the seasonability or alter the geographical distribution of water borne diseases.

In the marine environment, warm temperatures create favourable conditions for red tides( booms of toxic algae)-this increases the incidence of shellfish poisoning

Higher ocean temperatures may increase the incidence of ciguatera poisoning. This serious illness is associated with eating large fish that have accumulated toxins produced by dinoflagellates growing on bleached coral reefs. The illness is characterised by diarrhoea, vomiting and abdominal pain, then paraesthesiae and other neurological effects which may persist for weeks.

### **Increase in allergic manifestation**

Allergic manifestations are also expected to increase due to air pollution and also increase in pollens.

### **Measures taken by Ministry of Health & Quality of Life**

- As far as the adaptation of the health sector is concerned, the two main areas of focus has been, firstly, epidemic alert and response, and secondly the preparedness for natural calamities.
- In the field of epidemic alert and response, the main emphasis has been on disease surveillance and vector control activities.

- Disease surveillance has been reinforced at points of entry, where incoming passengers from endemic regions are screened for diseases with epidemic potential, particularly vector borne diseases.
- A follow up of such passengers is also undertaken at their place of residence.
- Apart from doctors in the public health institutions, sentinel doctors in the private sector are also carrying out passive surveillance for communicable diseases of major public health importance.
- In addition, the Ministry of Health and Quality of Life has initiated actions to carry out a reorganization of the Communicable Diseases Control unit aiming at strengthening the communicable disease surveillance system in the country, with focus on setting up of early warning and rapid response system. This project also goes in line with the recommendations made by WHO to member States to reinforce capacity for the implementation of the International Health Regulations.
- A department of epidemiology has also been attached to the unit. An epidemiologist has been recruited to this effect and two Community Physicians have also joined the department.
- The Central Laboratory has undergone major uplifting during the last few years, such that laboratory surveillance of diseases has largely improved. Actions have been initiated to further strengthen laboratory capacity in the wake of an imminent pandemic. Collaboration with other international reference laboratories is maintained.
- Vector control activities are ongoing throughout the year. An integrated approach has been adopted, of which environmental management to eliminate breeding sites, community mobilization, and the use of chemicals have been the main components. Vector surveillance is also an important component of the programme.
- The health services response to epidemics has been reinforced through the elaboration of contingency plans to cater for increased hospital surge and providing isolation facilities
- In regards emergency plans for natural calamities, a contingency plan exists for cyclones.
- Another plan has been established for tsunamis and this could well be adapted for floods and tidal waves.
- The Accident and Emergency services have been upgraded.

- Advanced pre-hospital care is provided through the SAMU department. This unit has also been providing training in first aid to potential first responders.
- The ICU set up has been upgraded, with the provision of additional beds and equipment.
- The Ministry has also invested heavily to provide up-to-date diagnostic equipment.

### Annex 3: Composition of working group 3

	Contact name	Organisation
1	Adam Eric	Association of Mauritian Manufacturers
2	Bagoban Kailash Shorab	Municipal Council of Beau-Bassin/ Rose-Hill
3	Bauhadoor Nirlup	Ministry of Public Infrastructure, National Development Unit, Land Transport and Shipping (National Development Unit)
4	Beedassy Ramanand	ECOBIOTECH
5	Beeharry Yashna	Student Association (University of Technology)
6	Bharosay R	Ministry of Industry and Commerce (Industry Division)
7	Bhugun Iqbal	Plateforme Maurice Environnement
8	Bokhoree Chandradeo	University of Technology
9	Brizmohun Ravina	Ministry of Environment & Sustainable Development
10	Bucktowansing Girish	MACOSS/Rotary
11	Bundhun Raifa	APEXHOM
12	Calloo-Rohimun Anissa	Mauritian Wildlife Foundation
13	Chaleon Stephanie	Agence Française de Developpement (Observer)
14	Daby-Seesaram Nadia	Institution of Engineers (Mauritius) - Enviro-consult Ltd
15	Dani Joseph	Croplife Mauritius
16	Deoraj Caussy	Ministry of Health and Quality of Life
17	Dev Sewpal	REDS LTD
18	Dinan Marie-Aimée / Leclezio Aurelie	Mauritius Bankers Association
19	Enouf Michael	Pamplemousses / Rivière Du

		Rempart District Council
20	Essoo Nuthooram	Atics Ltd
21	Ghurburrun Ravin Kumar	Representative of Outer Islands Development Corporation (OIDC)
22	Guriah Kreshny	Ministry of Local Government and Outer Islands (Solid Waste Management Division)
23	Gurreebun Khalick	Confederation des Travailleurs du Secteur Privé – CTSP
24	Imrit Leckraz	Federation of Public Sector and Other Unions (FPSOU)
25	Jauffur Shameem	Wastewater Management Authority
26	Jaypaul N	Ministry of Health & Quality of Life ( <b>Chairperson</b> )
27	Jhumka Hamid	Mauritius Chamber of Commerce and Industry (MCCI)
28	Joomun Saifuddin Saif	Municipal Council of Curepipe
29	Juddoo Prakash	Student Association (University of Mauritius)
30	Kowlessar Prakash	Ministry of Local Government and Outer Islands (Solid Waste Management Division) ( <b>Vice-Chair</b> )
31	Kux Andrea	Association des Hotels et Restaurateurs de l’Ile Maurice (AHRIM)
32	Lachkar Serge	Kgtex Ltd
33	Lai Choo Philippe	Institution of Occupational Safety and Health Management (IOSHM)
34	Lalljee V	University of Mauritius ( <b>Rapporteur</b> )
35	Le Vieux Philippe	Plateforme Maurice Environnement
36	Lobin Krishna Jay	Municipal Council of Vacoas

		Phoenix
37	Joseph Dani	Coroi Ltee, Croplife Mauritius as MCCI representative
38	Malabar Berty	B.E.M Enterprise Ltd
39	Maudho Adish	University of Mauritius ( <b>Vice- Rapporteur</b> )
40	Mooloo Santaram	Ministry of Environment and Sustainable Development
41	Mooneeram Ashvin	Mooneeram Associated Ltd
42	Pathel Yahyah	Ministry of Environment and Sustainable Development
43	Peerthy Soodeera / Bechard V	Women Association
44	Peerun Haniff / Auckbarally A. Reead	Mauritius Labour Congress
45	Pougnet Claude	Mission Verte
46	Quedou Dewan	Mauritius Trade Union Congress
47	Ragen A.K.	University of Mauritius
48	Ramlugon Rajiv / Sagnier Pierre	Mauritius Sugar Producers Association (MSPA)
49	Ramphul Judex	Fishermen Association
50	Ray Suraj	TESA-CITU
51	Sam-Soon Alan	Plateforme Maurice Environnement
52	Seebaluck Deepnarain	Black River District Council
53	Tatur-Ramasamy Daisy	Ministry of Environment and Sustainable Development
54	Thandrayen G	Ministry of Health and Quality of Life
55	Veerasamy Vidyasagar	Municipal Council of Quatre Bornes
56	Wade Clifton Stenio	Confederation Free Trade Union (CFTU)

57	Wilain Jean-Luc / Rose Marcon	Ireland Blyth Ltd
----	----------------------------------	-------------------

**Annex 4**  
**2007 Categories Waste of Electric and Electronic Equipments (WEEE)**

**1. Large household appliances**

Washing machines

Clothes dryers

Dish washing machines

Cooking

Electric stoves

Electric hot plates

Microwaves

Other large appliances used for cooking and other processing of food

Electric heating appliances

Electric radiators

Other large appliances for heating rooms, beds, seating furniture

Electric fans

Other fanning, exhaust ventilation and conditioning equipment

**2. Small household appliances**

Vacuum cleaners

Carpet sweepers

Other appliances for cleaning

Appliances used for sewing, knitting, weaving and other processing for textiles

Irons and other appliances for ironing, mangling and other care of clothing

Toasters

Fryers

Grinders, coffee machines and equipment for opening or sealing containers or packages

Electric knives

Appliances for hair-cutting, hair drying, tooth brushing, shaving, massage and other body

care appliances

Clocks, watches and equipment for the purpose of measuring, indicating or registering time

Scales

### **3. IT and telecommunications equipment**

Centralised data processing:

Mainframes

Minicomputers

Printer units

Personal computing:

Personal computers (CPU, mouse, and keyboard included)

Printers

Copying equipment

Electrical and electronic typewriters

Pocket and desk calculators

Other products and equipment for the collection, storage, processing, presentation or communication of information by electronic means

User terminals and systems (excluding display equipment)

Facsimile

Telex

Telephones

Pay telephones

Cordless telephones

Cellular telephones

Answering systems

Other products or equipment of transmitting sound, images or other information by

Telecommunications

### **4. Consumer equipment**

Radio sets

Videocameras

Video recorders

49

Hi-fi recorders

Audio amplifiers

Musical instruments

Other products or equipment for the purpose of recording or reproducing sound or images, including signals or other technologies for the distribution of sound and image than by telecommunications

## **5. Lighting equipment**

Luminaires for fluorescent lamps with the exception of luminaires in households

Other lighting or equipment for the purpose of spreading or controlling light with the exception of filament bulbs

## **6. Electrical and electronic tools (with the exception of large-scale stationary industrial tools)**

Drills

Saws

Sewing machines

Equipment for turning, milling, sanding, grinding, sawing, cutting, shearing, drilling, making holes, punching, folding, bending or similar processing of wood, metal and other materials

Tools for riveting, nailing or screwing or removing rivets, nails, screws or similar uses

Tools for welding, soldering or similar use

Equipment for spraying, spreading, dispersing or other treatment of liquid or gaseous substances by other means

Tools for mowing or other gardening activities

## **7. Toys, leisure and sports equipment**

Electric trains or car racing sets

Hand-held video game consoles

Video games

Computers for biking, diving, running and rowing

Sports equipment with electric or electronic components

Coin slot machines

**8. Medical devices (with the exception of all implanted and infected products)**

Radiotherapy equipment

Cardiology

Dialysis

Pulmonary ventilators

Nuclear medicine

Laboratory equipment for *in-vitro* diagnosis

Analysers

Freezers

Fertilization tests

50

Other appliances for detecting, preventing, monitoring, treating, alleviating illness, injury or disability

**9. Monitoring and control instruments**

Smoke detector

Heating regulators

Thermostats

Measuring, weighing or adjusting appliances for household or laboratory equipment

Other monitoring and control instruments used in industrial installations (for example, in control panels)

**10. Automatic dispensers**

Automatic dispensers for hot drinks

Automatic dispensers for hot or cold bottles or cans

Automatic dispensers for solid products

Automatic dispensers for money

All appliances which deliver automatically all kind of products

Refrigerants

Large cooling appliances

Refrigerators

Freezers

Other large appliances used for refrigeration, conservation and storage of food

Air conditioner appliances

Display equipment

Laptop computers (CPU, mouse, screen and keyboard included)

Notebook computers

Notepad computers

Television sets

Other products or equipment for the purpose of reproducing images

Gas Discharge lamps

Straight fluorescent lamps

Compact fluorescent lamps

High intensity discharge lamps, including pressure sodium lamps and metal halide lamps

Low pressure sodium lamps