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Waste Management

WASTE

Waste according to the Basel Convention is a substance or object which is disposed off or is intended for disposal or is required to be disposed off by the provisions of national laws. Waste may be generated during the extraction of raw materials, the processing of raw materials into intermediate and final products, the consumption of final products, and other human activities. Residuals recycled or reused at the place of generation are excluded.

The cycle of waste generation begins with mining activities during the extraction of raw materials. During the conversion of raw materials into consumer products, the manufacturing activities involve generation of industrial waste which comes in many forms. Finally, consumer products will end up as waste if they are no longer useful and are discarded as residential portions of municipal waste.

Effects of Improper Waste Handling

Waste that is not handled properly will have effects on human health and the environment. Below are the potential negative effects of municipal waste:

- Promotion of micro-organisms that cause diseases
- Attraction and support of disease vectors (rodents and insects that carry and transmit disease-causing micro-organisms)
- Generation of noxious odours
- Degradation of esthetic quality of the environment
- Occupation of space that could be used for other purposes
- General pollution of the environment

Today, Malaysians generate waste averaging about 1.7 kg per day/person of solid waste especially in major cities. If all waste is collected every day, estimated at more than 15000 tonnes, it will tower at a height of 4 times Kuala Lumpur Tower. According to Malaysia Country Report 2001, our solid waste contains very high organic waste and consequently very high moisture content and a bulk density of above 200kg/m^3.

Waste Reduction

As population increases, the amount of waste generated will naturally increase. The public should take the initiative to reduce the amount of waste entering the solid waste management system. There should be more effective use of the 3R and 4R programmes (reduce, reuse, repair and recycle) in waste management. Source reduction can be achieved by reducing the amount and toxicity of generated waste. Manufacturers can play a major role in this aspect through the design and manufacture of products with less toxic content and a longer useful life.

Waste Management

In order to ensure proper management of waste, it is vital that the type or types of waste being dealt with are identified. Different wastes need different handling treatment and disposal. There are many different ways of categorising waste depending on various factors such as where they are derived from or sources of generation as listed in Table 1. From each source of generation, the waste can be sub-categorised further based on the physical and chemical properties of the composition and risk to the environment and human health as described in the following page.

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From the desk of the Director General

"Waste Not What Not"

The parents of the present generation of Malaysians driven by the credo of frugality, repeatedly admonished us: "Waste Not, What Not!" Growing up in the small towns and villages of a generation ago, surely we all have memories of how this policy worked on the homefront: hand-me-down clothings, shoes, schoolbags and books; newspapers neatly stored and sold off just before the start of a new school year to fund additional expenses; 'washings' from the kitchen used as a fertiliser for flower plants and the vegetable patch, buttons and buckles carefully removed from old clothings to form the reserves of the mend and repair unit ever present in every home, old sheets and towels recycled as foot rugs and patchwork bed covers; worn out cotton mattresses taking on a new life as pillows and cushions; coconut husk doubling up as 'hard-dirt scrubbers'; chickens fed on pressed coconut gratings and old leftover food; …. and we can all add to this endless and ingenious list regarding reuse and recovery.

How things have changed? What has made us so profligate in our consumption and lifestyles that we now have to face an unrelenting tide of waste, which if not managed properly, will surely engulf us? Perhaps the answer lies in rising wealth levels, mass consumerism and thoughtless consumption. Take for example, e-waste which is essentially electrical and electronic waste. It poses serious environmental and health challenges. It is hazardous and is being generated at an alarming rate. It is estimated that in the USA alone, there will be 700 million obsolete computers in 2007. Other than computers, the use of mobile phones is growing exponentially. From 16 million users in 1991 it has grown to 1.3 billion globally in 2003. Scrapped units of both items contain heavy metals that are potentially hazardous to human health and the environment. The wastes of the bygone era of our parents are no match to the wastes of the present mass-consumer driven, technologically and chemically complex wastes of the present generation. And yet waste must be dealt with as in the past, with greater creativity and ingenuity. But first it will be useful to define wastes in a modern sense for a modern world.

The Basel Convention (1989) defined waste as substances or objects which are disposed or intended to be disposed or are required to be disposed off by the provisions of national laws. Clearly this definition requires a regulatory framework. This regulatory framework must identify the categories of waste and assist and promote the objectives of waste management. Taking waste as that which is required to be disposed off by the provisions of national laws, we can see broadly, that it will be generated during the extraction of raw materials into intermediate and final products, and various other human activities. Residuals recycled or reused at the place of generation clearly are excluded and the rest of the waste must be identified and categorised by the regulatory framework. Using the categorisation method, the principal sources of waste have their origin in Municipal, Commercial, Clinical, Industrial, Construction, Mining and Agricultural activities. Universally, proper waste management arising from these activities aims first to reduce damage to ecosystem quality; second to reduce damage to human health and third to slow down energy resource depletion.

In Malaysia, a new regulation namely the Environmental Quality (Scheduled Wastes) Regulations 2005 was enacted and came into force on 15 August 2005. Per this new regulation, scheduled wastes are categorised based on type of waste rather than the source of origin of the wastes. The new provisions instituted in the regulations include the special management of waste, limiting the amount and duration of waste, training for persons handling scheduled wastes and an improvement in labelling requirements. However, it must be pointed out that these regulations, in common with those in other countries, are essentially directed towards pollution abatement and control through implementation of waste treatment and disposal schemes. Though these regulations have contributed significantly to environmental protection, it is generally accepted that global material cycles in the biosphere are not in harmony with patterns of production and consumption. The new global thinking on sustainable waste management calls for the institutionalisation of practices for pollution prevention and waste minimisation aided by the powerful tool of life cycle assessment (LCA).

The LCA approach has been developed over the last two decades as a tool to compile and evaluate the inputs and outputs and the potential environmental impact of a product system through its life cycle based on a cradle-to-grave principle. The critical point in the LCA methodology lies in the impact assessment stage where environmental effects such as resource depletion, human toxicity and ecological damage during the life-cycle of a product can be integrally assessed. It can therefore be used by industries to make relevant decisions on environmentally compatible processes or product modifications. Such a strategy allows for minimisation of waste generation through the following means: reduction at source; product changes; process changes; on-site recycling; off-site recycling and optimised treatment and disposal of waste.

In 2004, industries in our country generated 470,000 tonnes of scheduled wastes. Of this, 58% was sent for recovery off-site, 22% was disposed, 11% treated on-site, 8% stored off-site and a small quantity exported for recovery. And we must take note that waste disposal will not become cheaper in both an economic and environmental sense. The present generation and the future generation must consume intelligently. Or in other words, we must become waste savvy. It will surely save our pockets and our world. **" Waste Not, What Not"– Why Not?**

Dato' Hajah Rosnani Ibarahim
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1 Waste categorisation based on chemical composition

Source of waste	Description
Organic aqueous waste	Waste of biological origin which can be in liquid or sludge forms. Broadly speaking, there are two types of organic waste: biodegradable wastes which break down readily in the environment such as food and garden waste; and persistent wastes (e.g. PCBs) which are those that do not readily break down and can persist in the environment for many years. Persistent organic waste can be hazardous.
Inorganic aqueous waste	Waste of non-biological origin which can be in liquid or sludge forms. Inorganic can be either metal or non-metal. Metals include heavy metals. Non-metals include cyanide and arsenic. Inorganic waste is often hazardous, and may also include chemically and biologically inactive waste.
Oily waste	Liquid waste consist of petroleum-derived oils.
Organic liquids	Liquid waste consist of non-aqueous solutions or spent solvents.

2 Waste categorisation based on reactivity and environmental risk

Source of waste	Description
Inert	Inert wastes refer to waste that is chemically and biologically inactive (i.e. non-biodegradable). Typical wastes include masonry and brick rubble, uncontaminated soils, ash (excluding that from incinerators) glass and plastics. Much of mining and construction waste is inert waste.
Non-hazardous	A general description of waste including municipal, commercial and industrial, which is not hazardous
Radioactive	Radioactive waste is waste which contains substances that emit ionizing radiation. Principal sources of radioactive waste include hospitals, nuclear power plants and industrial facilities. Nuclear (radioactive) waste is generated at various stages of the nuclear fuel cycle (uranium mining and milling, fuel enrichment, reactor operation, spent fuel reprocessing). It also arises from decontamination and decommissioning of nuclear facilities, and from other activities using isotopes, such as scientific research and medical activities.
Hazardous	A general description of waste which contains a toxic or harmful substance in such quantity as to cause death, injury or impairment to living organisms and the natural environment. Typical hazardous wastes include organic sludges (human and animal), contaminated soils, infectious, clinical/surgical waste, heavy metals and industrial waste. Hazardous waste is mostly generated by industrial activities. It represents a major concern as it entails serious environmental risks if poorly managed; the impact on the environment relates mainly to toxic contamination of soil, water and air.

3 Waste categorisation based on source of generation

Source of waste	Description	Waste composition
Municipal	Municipal waste is produced by a municipality and includes household, commercial office buildings, institutions and hospital waste.	Waste generally contains putrescible matter such as food waste, glass, paper, plastics. Bulky waste is yard and garden waste, street sweepings, content of litter containers, and market cleansing.
Commercial	Principal sources of commercial waste are premises used wholly, or mainly, for the purposes of a trade or business, sport, recreation or entertainment purposes.	General office waste, packaging waste and plastics
Clinical waste	Clinical waste can be hazardous to persons coming in contact with it. Principal sources of clinical waste are medical, nursing, dental, veterinary or pharmaceutical facilities.	Waste that consists partly or wholly of human and animal tissue, blood or other bodily fluids, excretions, drugs or other pharmaceutical products, swabs or dressings, or syringes, needles or other sharp instruments.
Industrial	Industrial waste includes metals, electronic components, hazardous and non-hazardous materials. Principal sources of industrial waste are facilities which undertake manufacturing processes of consumer products.	Organic or inorganic types of wastes either in liquid, gaseous or solid forms.
Construction	Principle sources of construction waste include excavation and demolition activities.	Construction waste is mainly inert in nature and includes rocks, topsoil, vegetation, timber, concrete, bitumen tarmacadam and liquid waste.
Mines and Quarries	Wastes from mines and quarries are generated during blasting, boring, excavations and dredging. Most mining or quarry waste is inert; however, hazardous waste can also be generated.	Waste includes rocks, spoil, timber, metal tailings and liquid waste (e.g. flushings containing nitrates, heavy metals and acids)
Agricultural	Principal sources of waste are any farming activities or agro-industry, such as abattoirs and tanneries.	Waste includes organic sludge effluents, unused pesticides and fertilisers, chemical containers and crop residues.

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Scheduled Waste Management: Issues and Challenges

Control of toxic and hazardous wastes in Malaysia dates back to the enforcement of Environmental Quality (Sewage and Industrial Effluents) Regulations 1979 on 1 January 1979. Regulations 9 and 10 provide for restrictions on the discharge of effluents and disposal of sludge on any soil or surface of any land unless with the written permission of the Director General of Environment. The purpose of this provision is largely to check, in the interim period, indiscriminate disposal of industrial waste on land.

Generation of hazardous wastes must be controlled to protect public health and the environment. We have learnt from the experience of developed countries that environmental problems associated with illegal and indiscriminate disposal of hazardous waste are detrimental to the environment and require costly clean-up measures. Realising the potential danger posed by improper management of toxic and hazardous wastes, the Government has extended much efforts since 1979 to identify possible options and necessary measures for its proper management. These include the identification, classification and quantification of the various types of toxic and hazardous wastes generated and its treatment and disposal. These efforts culminated in the formulation of three sets of regulations in 1989 for the management of toxic and hazardous wastes, termed as scheduled wastes in Malaysia, to ensure hazardous waste produced in the country is managed safely and in an environmentally sound manner.

A review of the Environmental Quality (Scheduled Wastes) Regulation 1989 to improve the management of scheduled wastes resulted in the coming into force of the Environmental Quality (Scheduled Wastes) Regulation 2005 on 15 August 2005.

Policies and Legal Requirements for the Control of Scheduled Wastes

Environmental Quality Act 1974

The Environmental Quality Act 1974 (EQA) was enacted on 22 March 1974, to prevent, abate and control pollution and enhance the environment. Since then, 30 regulations and orders have been introduced to deal with specific pollution problems from agro-based and manufacturing industries, air emissions from stationary and mobile sources, noise from motor vehicles and management of scheduled wastes. The EQA was amended in 1985 to make it mandatory for prescribed activities to undertake environmental impact assessment. In 1996, the Environmental Quality Act of 1974 was again amended and an explicit provision on the control of scheduled wastes was one of the inclusions made. It also addresses our international commitment, more specifically the *Basel Convention on the Control of Transboundary Movements of Toxic and Hazardous Wastes and Their Disposal.* This provision prohibits the following activities without prior written approval of the Director General of Environment:

1. Any placement, deposit or disposal of any scheduled wastes on land or into Malaysian waters except at prescribed premises;
2. Receive or send scheduled wastes in and out of Malaysia, and
3. Transit of scheduled wastes.

The EQA also allows environmentally hazardous substances to be prescribed which may then be required to be reduced, recycled, recovered or regulated in the form of a substance or product. The provision further empowers the authority to specify rules on the use, design and application of labels in connection with the sale of the substance or product.

Environmental Quality (Scheduled Wastes) Regulations 1989

The Regulations for the control of scheduled wastes are based on the "cradle-to-grave" concept where generation, storage, transportation, treatment and disposal are regulated. A total of 107 waste categories are prescribed as scheduled wastes. The regulations focused on the following key provisions:

1. Control of the generation of waste by a notification system;
2. Avoidance or minimisation of waste generation;
3. Safe storage of wastes;
4. Licensing of scheduled waste facilities;
5. Treatment and disposal of waste at prescribed premises; and
6. Implementation of the manifest system for tracking and controlling movement of wastes.

This act requires waste generators to notify the Department of Environment whilst the treatment and disposal of scheduled wastes can only be carried out at a licensed facility. The movement of wastes from the point of generation to the treatment facility is tracked by the use consignment notes.

Environmental Quality (Scheduled Wastes) Regulations 2005

After more than 15 years of enforcing the scheduled waste regulation, the Department of Environment encountered various shortcomings and a comprehensive review was carried out to address these shortcomings. A new regulation namely the Environmental Quality (Scheduled Wastes) Regulations 2005 was enacted and came into force on 15 August 2005. With the coming into force of this Regulation, the Environmental Quality (Scheduled Wastes) Regulations 1989 was revoked. The major change in the 2005 Regulation is that scheduled wastes are now categorised based on type of waste rather than the source or origin of the wastes. New provisions instituted include the special management of waste, limiting the amount and duration of waste storage, recovery of scheduled wastes, conduct of training for persons handling scheduled wastes and improvement in the labelling requirements.

Scheduled wastes are now categorised under five groups:

1. Metal and metal-bearing wastes;
2. Wastes containing principally inorganic

constituents which may contain metals or organic materials;

3. Wastes containing principally organic constituents which may contain metals and inorganic materials;
4. Wastes which may contain either inorganic or organic constituents; and
5. Other wastes.

These wastes were considered after reviewing hazardous waste categories from other countries as well as those prescribed under the *Basel Convention on the Transboundary Movements of Hazardous Wastes and their Disposal 1989.* Four types of wastes in the 1989 Regulations were deleted and 10 new waste categories were included in the new Regulations. The deleted wastes were effluents from rubber factory; effluents from textile factory; leachate from landfills and slag from iron and steel industry whilst those added were: galvanic sludges; leaching residue from zinc processing; electrical and electronic wastes; wastes gypsum; waste of organic phosphorous compound; wastes containing dioxin or furans; discarded chemicals; obsolete laboratory chemicals; wastes containing peroxides and residues from treatment of scheduled wastes. Also for the first time scheduled wastes generated are not allowed to be stored for more than 180 days after generation provided that the quantity of scheduled wastes accumulated on site shall not exceed 20 tonnes. However, any person may store more than 20 tonnes of scheduled wastes provided that the Director General of Environment grants a written approval unconditionally or subject to conditions. If the Director General has reason to believe that the scheduled wastes stored can result in an environmental or health impact, he/she may direct the waste generator to send any scheduled waste for recovery, treatment or disposal for such a period or up to a quantity as directed.

Under Regulation 7, a waste generator may apply in writing to have the scheduled wastes excluded from being disposed, treated or recovered at the prescribed premises. This is to give the waste generator an opportunity to prove that the wastes will not result in any adverse impact on the environment or public health. Toward this end, wastes generators must submit documentary evidence that the wastes do not exhibit any hazardous characteristics in terms of corrosivity, ignitability, reactivity and toxicity and also the wastes do not have hazardous effects on human or other life forms. Application must be in accordance with the guidelines for special management of scheduled wastes and accompanied by a prescribed fee of RM 300.

E-Waste

Electrical and electronic wastes or the so called E-waste has become a serious environmental and health challenge for two major reasons: (i) it is potentially hazardous, and (ii) it is being generated at an alarming rate. It is estimated that in the USA, by 2007 there will more than 700 million obsolete computers. European studies indicate that E-waste is increasing by 3 to 5 % per annum. Other than computers, the use of mobile phones is also growing exponentially. From 16 million users in 1991, it has grown to 1.3 billion globally in 2003. In Malaysia, currently there are more than 10 million mobile phone subscribers. This growth has created waste and it is a challenge to ensure waste emanating from this source does not end up in the landfills, releasing toxic substances to the environment. Computer scrap contains heavy metal such as lead, chromium and mercury that can be hazardous to human health and the environment if not managed properly. We should also be vigilant against dumping of used computers or mobile phones in the guise of refurbishment and recycling.

Realising the potential environmental impact of indiscriminate E-waste disposal, the Department of Environment has included these wastes as scheduled wastes in the Environmental Quality (Scheduled Wastes) Regulations 2005. These wastes are categorised as "waste from electrical and electronic assemblies containing components such as accumulators, mercury-switches, glass from cathode-ray tubes and other activated glass or polychlorinated biphenyl-capacitors, or contaminated with cadmium, mercury, lead, nickel, chromium, copper, lithium, silver, manganese or polychlorinated biphenyl". As this is a new category of wastes, existing operators are allowed to continue with their activity of recovery under license. The Department has licensed 30 facilities for partial recovery and one for full recovery of E-waste. Partial recovery refers to the process where the recovered materials, in this instance metals, require further recovery processes to produce the final product. The partially recovered materials are still considered as scheduled wastes and need to be treated at prescribed premises.

Basel Convention on Transboundary Movements of Hazardous Wastes and Their Disposal 1989

Concerned and alarmed at the uncontrolled and unregulated movement of hazardous wastes, the United Nations Environment Programme (UNEP) initiated the *Basel Convention on the Transboundary Movements of Hazardous Wastes and Their Disposal in 1989* that was adopted at a ministerial conference in Basel, Switzerland on 22 March 1989 and signed by 116 countries. The Basel Convention, with its many apparent weaknesses, has been a good attempt by the international community to respond to the urgent question of uncontrolled movement of hazardous wastes.

The main objectives of the Basel Convention are:

1. to protect human health and the environment from adverse effects of hazardous wastes; and
2. to reduce their generation and transboundary movement and to ensure environmentally sound management of hazardous wastes.

The Convention addresses the need to protect countries against illegal importation and to strengthen the capacity of all states to adequately manage their hazardous wastes.

During its first decade, the Convention was principally devoted to setting up a framework for controlling 'transboundary' movement of hazardous wastes, that is, the movement of hazardous wastes across international frontiers. During the next decade, the Convention will build on this framework by emphasising full implementation and enforcement of the treaty's commitments. The Basel Convention contains specific provisions for monitoring implementation and compliance. A number of articles in the Convention oblige Parties to take appropriate national measures to implement and enforce its provisions, including measures to prevent and punish acts of contravention of the Convention.

Malaysia became a Party to the Basel Convention on 8 October 1993 and as of May 2006 the total number of Parties to the convention is 168. The Department of Environment (DOE) is the Competent Authority in the implementation of the Basel Convention in Malaysia. National legislation in the form of Section 34B of the Environmental Quality Act 1974 on the control of scheduled wastes and the Environmental Quality (Scheduled Wastes) Regulations 2005 have been enacted to regulate, control and restrict movements of hazardous wastes exported, imported or that which transits in the country. A control mechanism based on prior written notification and consent was also put into place in line with the provisions of the Convention. However the transboundary movement of hazardous wastes is regulated under the Customs Act of 1967, specifically the Customs (Prohibition of Import) Order 1993 and 1998 and the Customs (Prohibition of Export) Order 1993 and 1998. The export and import of wastes as listed in the Orders have to be accompanied by a letter of approval issued by the Director General of Environment. Hence the Royal Customs Department of Malaysia plays a very important role in preventing the illegal trafficking of hazardous waste through prohibition of imports and exports of waste governed by the above national legislations.

The movement of wastes is monitored using the consignment notes. Section 34B of the Environmental Quality Act, 1974 provides the maximum penalty of RM 500,000 or imprisonment for a period of five years or both for any violation of this section.

Scheduled Waste Management Facilities

Aware of the need to set up a proper hazardous waste treatment and disposal facility in the country, the government has promoted the establishment of environmentally sound treatment, recovery and disposal facilities.

Such facilities were also required to support the enforcement of legal provisions on scheduled waste. By having such facilities, industries in Malaysia are able to dispose waste in an orderly, regulated manner to avoid costly movements to other countries, and even more importantly, to avoid unnecessary risk to public health and the environment during its transport. To date two such facilities have been licensed for treatment and disposal of scheduled wastes, one in Negeri Sembilan and the other in Sarawak. Besides these facilities, there are three operators licensed to treat clinical wastes and 65 off-site facilities that are able to accept scheduled wastes for recovery.

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Dirty Material Recovery Facilities

Material Recovery Facility (MRF) is a term used to describe a place or facility capable of processing waste for sorting, cleaning, bulking and later use as raw materials for remanufacturing and reprocessing. A MRF will typically be an enclosed facility dealing with several mixed recyclable waste streams. MRF is aimed at resource recovery by means of mechanical and manual separation of waste.

Material Recovery Facility consists of several waste treatment systems, capable of processing solid waste for resource recovery. The process converts waste:

1. to recover commodity grade materials for sale;
2. to recover a mixed residual material for subsequent processing;
3. to convert into a secondary material; and
4. to convert waste into stable, non-pathogenic waste – inert waste. The inert waste will be directed to a sanitary landfill.

Basically, two processes are used for recovery of resources:

1. Physical process

– inclusive of mechanical and manual sorting of recyclable products such as paper, plastics, metal, aluminum etc.
– Refuse Derived Fuel(RDF), turning solid waste into pellets as co-incineration products for generation of energy to replace other fuels.
– Construction & Demolition (C&D) Waste Recovery System, turning construction waste into bricks, pavement and building materials (mainly for landscaping).
– Plastic Board Recovery System, turning various types of plastics into board form to replace wood as raw materials.

2. Biological process

– Composting, biodegrading into compost as agricultural products.
– Converting various types of waste to energy processes.

MRF aims to maximise the quantity of recyclables recovered, while producing materials that will generate the highest possible revenues in the market. MRFs fall into two categories : Dirty MRF and Clean MRF.

About Dirty MRF

Much of the waste of the nation is commingled waste, with a moisture content of 55% making it wet, greasy, sticky and with 60% of organic waste with low calorific value and low combustibility. Therefore, Dirty MRF needs proper environmental monitoring. Moreover, measures must be initiated to safeguard the safety and health of the operators at all times.

To date, the Solid Waste Management (SWM) industry has yet to invent a pattern recognition device for contaminants separation. Therefore, whatever the ergonomic design, it must be practical, serving both mechanical and manual separation processes. Only then is it likely to help the operators function efficiently to treat dirty commingled waste. Unfortunately there is no safe management solution where waste is concerned, especially Dirty MRF. So, all possible precautions, must be taken at all times to ensure operator's safety.

In designing a Dirty MRF system, factors such as climate, waste composition, social economic and environmental objectives must be taken into consideration. Moreover, the three basic principles of Rationality, Practicality, & Reliability must be kept in mind.

1. Rationality – The Dirty MRF design must take into consideration the economic, climatic and waste characteristics factors to ensure maximum recovery of waste, achieving better and more stable quality of compost and RDF products.
2. Practicality – The system must be free of "over-designed" equipment to facilitate operation and maintenance. Equipment that is too technical may not be suitable for Dirty MRF.
3. Reliability – The system must be built to be durable so as to achieve the objectives of environmental protection, labour safety and returns to investment.

The 5 E Objectives for Dirty MRF

The 5 E objectives will assist in achieving the waste management goal and enhance the results of waste management for Dirty MRF.

1. Environmental

- From waste management to the concept of "resource" management in identifying the best practicable environmental option that provides the most benefit or the least damage to the environment as a whole;
- Reduce the effect of traffic (pollutants movement) on the environment;
- Enhance and protect the quality of the natural environment.

2. Ecological

- Reduce levels of pollution to prevent damage to biological and chemical diversity of the ecology;
- Make optimum use of land to maintain ecological harmony; and
- Maintain the ecological health of streams, lakes, wetlands, and rivers for fauna and flora.

3. Economic

- Must involve minimum investment and maximum resource recovery;
- Offer existing waste sorters or scavengers the opportunity for a rewarding and satisfying employment; and
- Reasonable overall expenditure.

4. Efficiency

- Improve and maintain the quality of life and community well being to reflect the national and regional strategy of MSW management;
- Ability to access a range of services and facilities to meet basic needs of people;
- Improve overall health and environment for human beings; and
- Maximise efficient use and generate bio-products from waste.

5. Effectiveness

- Functional system design that is user-friendly and not "over designed"; and
- Achieve the Principles of Rationality, Practicality and Reliability.

Safety, Environment and Pollution Control

A proper Dirty MRF facility will consist of a sub system for air and gas collection, a treatment system for leachate and surface drainage, and protection for soil and ground water, taking into consideration the other components that make up the total solid waste management system. Measures instituted to protect the environment are usually expensive and do not provide returns to investments.

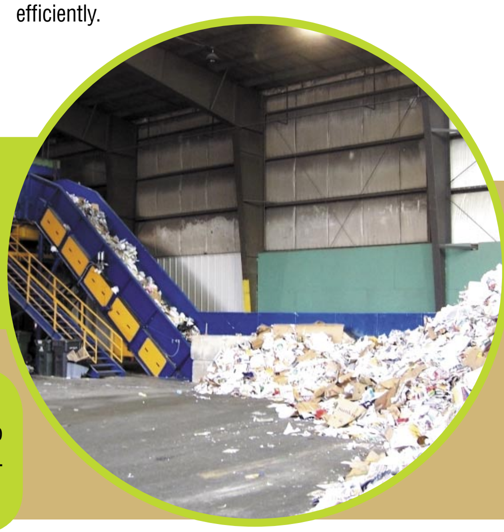
The MRF facility is usually enclosed to control noise. As shredding, baling and screening are dust-producing operations, dust collection systems and fans will be incorporated into the facility design. To combat the odors that result within the enclosed facility, a filtered ventilation system using ventilation and a bio-filter system is installed. Air emission controls are installed to prevent air pollution that could negatively impact the environment. Facility personnel are required to use personal protection equipment, such as hearing protection, safety helmets, safety shoes, dust masks, eye masks etc.

Leachate Collection and Treatment

Leachate is "garbage juice" or liquid effluent produced from the decomposition of organic matter by the action of precipitation percolating through a landfill. When leachate leaches out from the waste, the content in the leachate (mainly organic metals and suspended solids) may cause severe contamination. To prevent contamination, the leachate is collected from the tipping bunker from the sorting and compacting area through a piping and drainage system. Simple laboratory facilities are available for water analysis, especially the COD test. Much of the leachate collected will be used to maintain the moisture of the compost. Leachate discharges from the Dirty MRF processing flow is treated in a specially designed treatment plant.

Conclusion

The Dirty MRF facility, if designed to incorporate reasonable balance, is cost-effective and sustainable, accords environmental benefit, and offers socially sensitive solutions. It will contribute towards solving current municipal solid waste management problems. Municipal solid waste management is not fully profit orientated. The main principle that MRF operates on is to use waste as a resource to produce secondary or new consumer goods or materials from yesterday's discards, by taking into consideration environmental impacts. An unsuitable MRF system and/or poor management will not help alleviate the problem of treating solid waste effectively and efficiently.



CLEAN MRF

Clean MRF will process source separated recyclables, which are mostly clean and dry waste. This is an exclusive well-engineered process with more auto-sorting equipment and less manual sorting facilities

DIRTY MRF

Dirty MRF will process mixed waste that has undergone little or no segregation at the originating point. This process uses less auto-sorting equipment and more manual sorting facilities.

Comparison between Clean MRF and Dirty MRF

PARTICULARS	CLEAN MRF	DIRTY MRF
1. Segregation	Yes, at the origination point	With little or no segregation at the origination point
2. Texture of waste	Mostly clean & dry waste, inorganic waste	Dirty, wet & commingled or mixed greasy & sticky waste with both organic & inorganic wastes
3. Sorting Process	Exclusive, advanced & well-engineered design system, with more auto mechanical sorting using Trommel, Eddy Current, Magnetic Separator, Air Classifier, Glass Auto-sorting, Plastic Auto-sorting, Finger Screen Less manual sorting	Simple mechanical sorting, but more manual sorting
4. Incineration	Stable waste composition Less pollutants High calorific value Less fuel (dry waste) consumption	Unstable waste composition More pollutants, Low calorific value More fuel (wet waste) needed
5. RDF	Stable quality Less pollutants Need less energy for drying process	Unstable quality More pollutants Need more energy for drying process, especially during raining season Due to low heat drying process, bacteria & virus may not be destroyed Handling finely ground RDF has its peculiar problems: 1. Its low density makes it more difficult to transport, especially when it is wet; 2. Ground RDF is likely to decay very rapidly, therefore limiting its storage time; and 3. Its ease of decay results from the high compressibility fluffs which create high temperature within the refuse, thus encouraging microbial activity, releasing hydrogen during the fermentation. Therefore, risks may emerge during storage and combustion
6. C&D	No C&D waste	More C&D waste
7. Composting	Mainly off-site	On-site composting, inclusive of aerobic or anaerobic composting
8. Waste to energy	Off-site	On-site
9. Environmental Facilities	Less cost for installation of pollutant treatment, control & monitoring system	Higher costs for installation of pollutant treatment, control & monitoring system inclusive of odour, gas and dust collection and leachate collection
10. Waste Receiving Area	Dry waste, normally on tipping floor	Wet waste, in tipping bunker or pit.

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Sustainable Waste Management

Waste management has often been perceived by the waste generators, in particular the industry, as cost-incurring operations to comply with the regulatory requirements. Further, these operations are generally thought of as eroding the profitability of their businesses. This is attributable to the fact that environmental regulations currently enforced in Malaysia, like in most other countries, are directed essentially towards pollution abatement and control through the implementation of waste treatment and disposal schemes, with the aim of conforming to the stipulated discharge or emission standards.

Although such a practice, referred to as 'end-of-pipe' approach, has contributed significantly to environmental protection, and is still recognised as the most effective tool from a regulatory control perspective, it is gradually being regarded as a non-ideal ultimate approach to sustainable environmental management. In fact, such an approach has, in certain cases, proved grossly inadequate and problematical. It has resulted in the transfer of pollutants, particularly those categorised as hazardous, from one medium to another

Sustainability and Waste Minimisation

Waste management issues and problems have become increasingly acute with intensification of anthropogenic activities. Also, there is increased awareness that such activities must be brought in harmony with the global material cycles in the biosphere. Sustainable development has therefore become a key issue that calls for meeting the needs of the present without compromising the ability of future generations to meet theirs.

In line with this concept of sustainability, it is imperative that a process of drastic and far-reaching changes in the pattern of production and consumption, which almost invariably culminates in the generation of wastes, be instituted based on a life cycle approach. It entails the institutionalisation of practices for pollution prevention and waste minimisation, aided by the tools of life cycle assessment. The strategy encompasses reduction, reuse, or even elimination of waste sources through prevention and recycling of the wastes generated. It must be noted here that the emphasis is on conservation of resources, energy and water, which is obviously more environmentally sound and acceptable. Minimisation of waste generation is achieved through one or more of the following:

- Reduction at source
- Product changes
- Process changes
- On-site recycling
- Off-site recycling
- Optimised treatment and disposal.

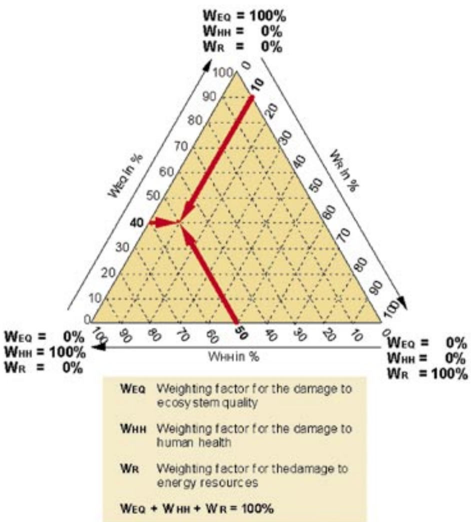

Figure 1: The mixing triangle at the impact assessment stage in typical LCA analysis, showing the weighting of damage to ecosystem quality, human health and energy resource depletion

Specific actions are taken pertaining to the assessment of sound and innovative process technologies, incorporation of pertinent R&D, professional engineering design as well as good management practices, for adoption by the industry. The aims are as follows:

1. Increase efficiency in the use of raw materials, energy, utilities, land and water resources;
2. Eliminate or reduce the extent of harmful wastes generated during production, ensure minimum hazard to human health, and reduce the risk of possible climate change and depletion of the ozone layer; and
3. Recycle products after their use to produce the same or other marketable products.

These and other related aspects are part of Malaysia's Green Strategies aimed at integrating environmental considerations into development activities and decision-making processes as enshrined in the National Policy on the Environment.

Life Cycle Assessment

Life cycle assessment (LCA) has been developed over the last two decades as a tool to compile and evaluate the inputs and outputs and the potential environmental impacts of a product system throughout its life cycle based on the cradle-to-grave principle. LCA studies comprise four phases, namely: definition of goal and scope; inventory analysis; impact assessment; and interpretation of results. The critical point in LCA lies in the impact assessment (LCIA) stage where the environmental effects, such as resource depletion, human toxicity and ecological damage, during the life cycle of a product can be integrally assessed. It necessitates a balanced consideration, or weighting, of the selected damage indicators in quantitative terms. This bottleneck is illustrated in Figure 1, a weighting alternative proposed by the Eco-indicator 99 methodology using the mixing triangle concept of Hofstetter, whereby the impact categories are reduced to three main categories: damage to human health, ecosystem quality and energy resources, displaying the correlation between the damage indicators concerned.

Interpretation of the results of the inventory and impact assessment from the perspective of the goal and scope definition provides valuable information pertaining to the environmental performance of processes in a product system. It satisfies the desire of industries to make proper, informed decisions on environmentally compatible processes or product modifications. From the perspective of waste management, though constituting only a component of the whole product system, such information is vital to the planning and implementation of cost-effective measures aimed at improving the overall environmental performance through identifying opportunities to reduce raw materials consumption and waste generation.

Open lagoon system commonly used in POME treatment

Palm Oil Production as a Case Study

Malaysia presently produces 15 million tonnes of crude palm oil annually, accounting for 45% of total world production. As a prime contributor to Malaysia's export earnings, with a total export value of oil palm products amounting to some 28 billion ringgit, the palm oil industry is facing increasing market demands on its environmental performance.

As common in all agroindustries, palm oil milling generates enormous quantities of waste, both solid and liquid. Essentially, these include empty fruit bunch (EFB), mesocarp fibre, palm kernel shell (PKS) and palm oil mill effluent (POME). The traditional use of fibre and PKS as boiler fuels has rendered the industry largely self-sufficient in energy needs, while reducing the amount of 'wastes' to be handled. EFB mulching and land application of partially treated POME for nutrient recovery have become popular practices among plantations. Yet the industry is still faced with certain environmental and waste management issues.

Recent years have seen increased interest in using LCA as a tool for analysing and assessing the environmental impacts of palm oil production, spanning the stages of plantation, transportation and milling. Findings reported to date reveal that, in terms of waste generation, POME exerts the most significant impact under the climate change impact category due to the fact that open lagoon systems are commonly used for its treatment, resulting in the emission of greenhouse gases from anaerobic digestion in the form of biogas consisting of carbon dioxide, and particularly methane which has a global warming potential of 21. The other impacts are associated with the use of fossil fuel mainly in transportation, and inorganic fertilisers in the plantation.

For sustainable waste management in the palm oil sector, it is obvious that biogas capture from the open lagoon POME treatment systems is the prime consideration. Methane is a renewable energy source which can be readily harnessed as a substitute for fossil fuel for heat and power generation. Unutilised EFB, which in many cases is being discarded, can be turned into boiler fuel for the same purpose, or used in combination with POME, in either the raw or the digested form, for the production of compost fertiliser.

Anaerobic reactor system for recovery of biogas from POME treatment

These schemes will not only mitigate the negative environmental impacts arising from palm oil production through waste reduction and resource recovery, but also contribute positively to the alleviation of energy resource depletion. Such aspects have been included in a framework of *Principles and Criteria for Sustainable Palm Oil Production* being promoted by the Roundtable on Sustainable Palm Oil (RSPO). Besides, such projects will be rendered economically viable from additional revenue provided through the generation of Certified Emission Reductions (CERs) pursuant to the Clean Development Mechanism (CDM) under the Kyoto Protocol of the United Nations Framework Convention on Climate Change (UNFCCC).

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Waste to Wealth
How it Works in Malaysia

Waste is often defined as something unwanted and has no economic value. However, increasingly waste is beginning to be seen as a resource with certain economic values for another user.

In many countries including Malaysia, waste quite often represents jobs, financial opportunity, raw materials for new products as well as an economic lifeline for some people. Possible "wealth" can be generated from various kinds of waste with appropriate technology as illustrated in Figure 1.

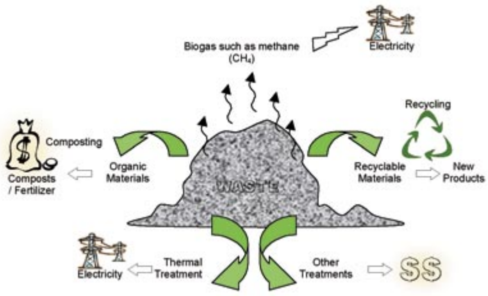


Figure 1: Basic concept of waste-to-wealth

Considerable revenue can be generated from heaps of waste through:

a) Recycling of useful materials from municipal solid waste
b) Generation of energy from municipal or agricultural wastes (such as palm oil empty fruit bunches and animal waste)
c) Production of composts or fertiliser from organic municipal and agricultural waste, or even sludge
d) Other specific technologies to convert wastes to useful materials (such as converting rice husk to charcoal, sludge to bricks, extraction of oil from used plastics, conversion of used tyres to carbon black and rubber granulates etc.)

Recycling of Waste

In Malaysia, recycling of waste is an established business. People have been collecting old newspapers, glass bottles, metals and other materials to be recycled into useful products for decades. To date, there are many different players involved in the recycling business, ranging from small primary paper collectors or landfill scavengers to a medium scale scrap metal middleman and a large recycling industry.

The average prices of recyclable materials at different levels of recycling in the markets are shown in Table 1 below:

Table 1: Price comparison for recyclable materials at different levels of recycling

No	Recyclable Materials	Selling Prices		
		Primary Collectors	Recycling Centres	Middlemen / Trader
1	Aluminium cans	RM0.35 - 3.00/kg	RM1.70 - 5.00/kg	RM2.50 - 5.50/kg
2	Car Batteries	RM1.00 - 3.00/Pcs	RM0.60/kg or RM5-10/pcs	RM1.75/kg - 13.00/pcs
3	Carton boxes (cardboards)	RM0.07 - 0.40/kg	RM0.10 - 0.55/kg	RM0.07 - 0.80/kg
4	Copper	RM1.00 - 3.20/kg	NA	RM1.00 - 9.50/kg
5	Glass Bottles	RM0.05/kg or RM0.16/pc	RM0.03 - 0.25/kg	RM0.05 - 3.00/kg
6	Other Papers	RM0.10 - 0.30/kg	RM0.15 - 0.50/kg	RM0.20- 0.70/kg
7	Old Newspaper	RM0.10 - 0.30/kg	RM0.10 - 0.35/kg	RM0.15 - 0.42/kg
8	Paper (computer)	RM0.20 - 0.30/kg	RM0.20 - 0.45/kg	RM0.20 - 0.60/kg
9	Paper (Pure white)	RM0.20 - 0.30/kg	RM0.20 - 0.45/kg	RM0.50 - 0.80/kg
10	Paper (Magazine Book)	RM0.20 - 0.30/kg	RM0.30 - 0.50/kg	NA
11	Waste Plastics	RM0.10 - 0.70/kg	RM0.15 - 0.90/kg	RM0.18 - 1.10/kg
12	Scrap Metals	RM0.15 - 3.00/kg	RM0.20 - 5.00/kg	RM0.25 - 7.00/kg

The recycling business can generate considerable income. Based on waste composition analysis and current average market prices of major recyclable materials, rough estimations on potential value of recyclable materials in the waste stream of Malaysia are shown in Table 2.

Table 2: Values of recyclable materials in the waste stream

Composition	Percentage (%)	Amount (tones/year)	Market price (RM/kg)	Values (Million RM)
Papers	17.1	1,026,000	0.20	205.2
Plastics	9.1	546,000	0.30	163.8
Glass	3.7	222,000	0.05	11.1
Aluminium	0.4	24,000	2.00	48.0
Scrap Metals	1.6	96,000	0.50	48.0
Other non-recyclables	68.1	4,086,000	-	-
Total	100.0	6,000,000	-	476.1

Note: 1) Waste composition data obtained from Ministry of Housing and Local Government (2005)
2) Total waste generation was estimated at 6 million tones per year
3) Average market prices were based on prices at recycling centre as of September 2005; actual prices at recyclable agents, middlemen and end buyers (industries) are usually much higher

A simple small home-based plastic recycling industry in Perak is described in Figure 2.

Waste-to-Energy

Energy from waste can be generated in two possible ways, namely through the decomposition process of waste and combustion of waste (See Figure 3).

The bacterial activities in the decomposition process of organic substances in the waste will generate biogas (such as methane gas), which is a source of renewable energy. A common example for waste-to-energy from biogas is landfill gas which can be captured and used to generate electricity.

Energy generated is both a source of income, and an entitlement to carbon credit under the Clean Development Mechanism (CDM), which was established under the Kyoto Protocol. CDM allows governments or private entities in industrialised countries to implement emission reduction projects and receive credit in the form of "certified emission reductions" or CERs.

Door-to-door Collector

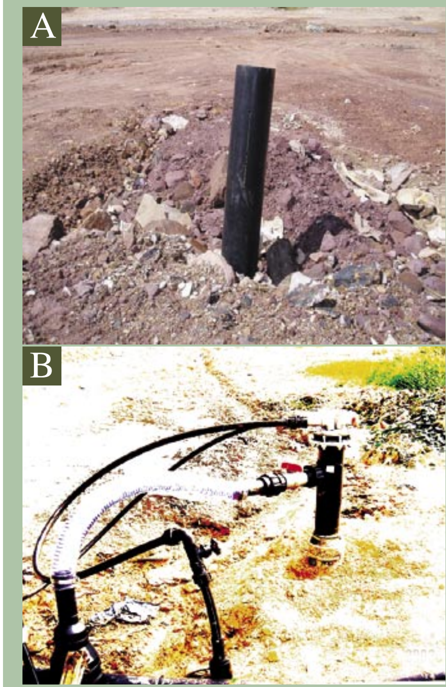
Landfill Scavengers

Middleman who recycle

Recycling Industry

- Production = 60tones/month (40% PET bottles and 60% shredded HDPE)
- Buying price of the scrap plastics = RM0.80 – 0.90/kg
- Products sold to buyer at RM1.50/kg
- Estimated Profit = 60tones/month x RM0.50 (gross profit) = RM 30,000/month

Figure 2: Small home-based plastic recycling industry



Landfill Gas Pipes(A) used to capture landfill gas(B) to generate energy

Besides municipal solid waste, energy may also be generated from other types of organic wastes such as sewage sludge, palm oil mill effluent (POME) and animal waste.

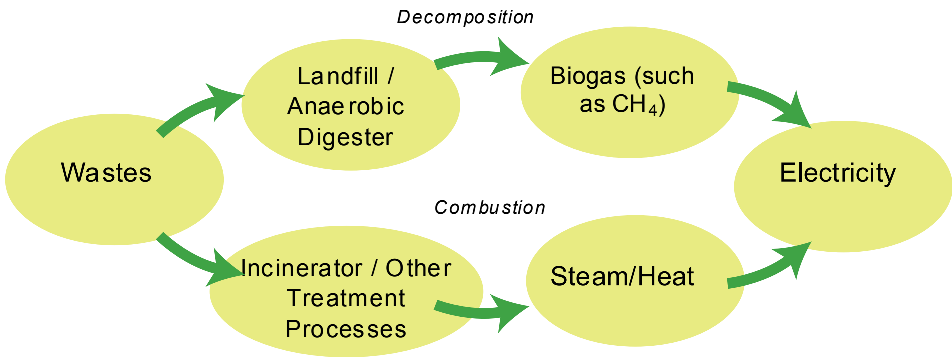


Figure 3: Waste-to-energy from waste

On the other hand, the waste-to-energy from a combustion process requires a waste incinerator or other thermal treatment processes. In Malaysia, there are only a few small scale incinerators for medical wastes and municipal solid wastes and these operations are all located in highlands and islands. However, a Refuse Derived Fuel (RDF) plant in Semenyih is in operation currently, processing up to 700 tons of municipal solid wastes everyday to produce about 5MW of electricity, which will be supplied to the national grid at a selling price of about RM0.17/kW.

Waste Composting

Composting is generally used for agricultural wastes which are more homogeneous in nature.

Example of Waste-to-Energy RDF plant in Malaysia (Photos extracted from MMC, 2006)

Malaysia, as the world's largest producer and exporter of crude palm oil, disposes of more than 30 million tonnes of palm oil wastes every year. It makes up over 10 million tonnes per year of empty fruit bunches (EFB) and more than 20 million tonnes of POME. A portion of the EFB is turned into composts by mixing with POME to produce quality composts which

Continued on page 12

Composting of palm oil empty fruit bunches (EFB)

Continued from page 11

are used as soil conditioners for farming. Similarly, compost is also produced by mixing sawdust and chicken manure. Compost prices in Malaysia range widely from RM180 to RM1,000 per ton depending on demand and compost quality.

Heaps of scrap tyres generated in Malaysia

Waste to Wealth: Other Sources

Recycling of Scrap Tyres

Data from the Malaysia Industrial Development Authority (MIDA) shows that Malaysia generates about 150,000 tonnes of scrap tyres every year. Scrap tyres can be recycled to recover about 40% of fuel oil, 40% of carbon black and 11% of steel.

Scrap tyre recycling companies are producing valuable materials from scrap tyres such as steel, rubber granulates and rubber powders.

Table 3: Number of computers and phones in Malaysia

Years	1999	2000	2001	2002	2003
Total Computers[1]	1,794,248	2,187,850	3,001,500	3,556,415	4,183,684
Total Phones[2]	2,717,000	5,122,000	7,385,000	9,053,000	11,124,000

Source: 1) International Telecommunication Union Eric Lie ITU Strategy and Policy Unit Digital Bridges Symposium Busan, Republic of Korea, 10 - 11 September 2004. Digital Bridges: The Case of Malaysia
2) Malaysian Communication and Multimedia Commission (MCMC)

The process flow for a scrap tyre pyrolisis plant in Klang is shown in Figure 4.

The company processes about 10,000 tonnes of scrap tyres yearly to produce fuel oil, carbon black and steel, sold at RM1.50/kg, RM0.50/kg and RM1.00/litre respectively.

Recycling of E-waste

Waste from electrical and electronic appliances (E-waste) (Figure 5) is valuable especially for e-waste recyclers. E-waste covers a wide range of electrical and electronic products including major consumable appliances such as televisions, phones, computers, refrigerators, radios, etc.

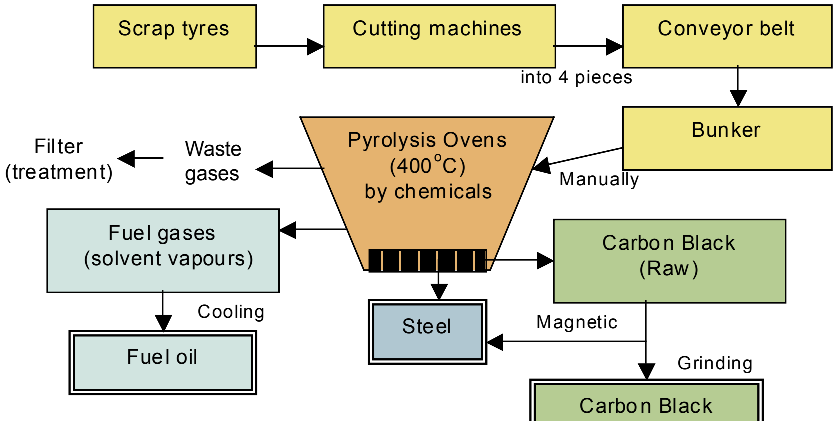


Figure 4: Scrap tyre pyrolisis process flow

E-Waste can be recycled

Statistics on the total quantity of e-waste generated per year is vague. However, e-waste generation is directly related to number of appliances used in the country, which can be estimated from various sources as shown in Table 3 .

In addition, it was estimated that there is about 3.5 million refrigerators, 9.4 million radios and 4.5 million television sets in residential homes in Malaysia. Based on the figures, e-waste for year 2004 was estimated to be approximately 380,000 to 430,000 tons.

The valuable materials recovered from e-waste include plastic casing of the appliances, glass, and various kinds of metals such as lead and copper as well as platinum and gold from the electrical circuit boards.

Conclusion

Waste management is recognised as having the dual functions of resource recovery and final disposal. People all over the world are earning revenue from both stages through recovery of recyclable materials and to some extent, conversion of waste to energy. Waste is no longer something that is unwanted. It is now regarded as resources for businesses that generate income. Turning waste into wealth not only makes good environmental sense, but also turns “trash” into “cash”.

“Turning Waste into a Resource Makes CENTS”.

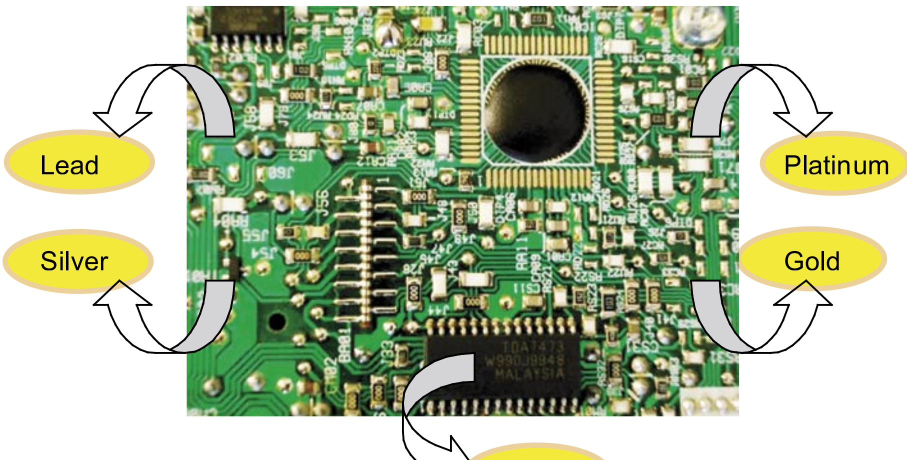


Figure 5: Waste from electrical & electronic appliances

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Continued from page 5

Issues and Challenges In Hazardous Waste Management

The 15 years experience gained through the administration of the scheduled wastes regulations indicate that hazardous waste management in the country has, to a great extent, met the primary goals of the EQA. In 2004, industries generated about 470,000 tonnes of scheduled wastes. Of this, 58% was sent for recovery off-site, 22% was disposed, 11% treated on-site, 8% stored on-site and a small quantity exported for recovery. Most of the industries are managing hazardous waste in accordance with the control procedures. However, there are still issues that confront the authorities in dealing with the management of scheduled wastes. These include illegal dumping, increasing request to recover/reuse wastes and new and emerging issues of contaminated land.

Illegal Dumping of Scheduled Wastes

Generally there seems to be an increase in the number of illegal dumping cases detected by the Department in the last five years; from 3 cases in 2001 to 31 cases in 2005. The types of wastes dumped were mainly waste paint, mineral oil and dross. These activities were mostly carried out in secluded areas to avoid detection. There were also factories that buried their wastes within their premises. However, the amount of wastes dumped illegally was small compared to the total amount of wastes generated in the country. This does not mean that we can treat this issue lightly because these wastes can contaminate groundwater and nearby rivers as well as affect public health.

Illegal dumping cannot be attributed to lack of facilities because we have a state-of-the-art integrated hazardous waste treatment and disposal facility. Lack of awareness, accountability, responsibility and sheer wanton disregard for the environment and public safety, as well as greed for maximum profit could be the reasons.

Recovery/Reuse of Wastes

Malaysia upholds, practices and promotes resource conservation. Therefore any waste that could be utilised should be reprocessed into useful products. Whilst we encourage waste recovery and reuse, DOE has been receiving applications considered 'questionable' such as recovery of products that appear to fall in the category of scheduled wastes and requests for non categorisation of their wastes as scheduled wastes, thus facilitating disposal at non-prescribed facilities. The Department has to take cognizance of the agreement between the Government of Malaysia and Kualiti Alam Sdn Bhd that amongst others prohibits the issuance of any license for another treatment and disposal facility in Peninsular Malaysia. This includes off-site incineration of scheduled wastes.

Contaminated Land

Although the EQA provided powers to DOE to prohibit pollution of any soil or surface of any land, it has not gone further to specify the acceptable conditions for deposition of wastes into this segment or element of the environment. However, Environmental Quality (Scheduled Wastes) Regulations 2005 categorised contaminated soil, debris or matter resulting from clean-up of a spill of chemical, mineral oil or scheduled waste as a scheduled waste, subjected to the provisions of the scheduled waste regulations requiring treatment or disposal at prescribed premises.

Potential contaminated land can be found in places such as motor workshops, petrol stations, fuel oil depots, railway yards, bus depots, landfills, industrial sites and sites with underground storage tanks. These places generate spent diesel, lube oil, other hydrocarbons, solvents and grease, which if not properly managed could end-up polluting the soil and groundwater through leakage and seepage. There are also contaminated sites that remain hidden or unknown such as municipal landfill and refuse dumping sites that have been abandoned in the past.

Assessment of soil contamination at industrial premises is still ad-hoc and has yet to provide any significant profile on the status of soil quality. This is carried out on some of the sites where illegal dumping of hazardous waste has occurred. In most of these cases, the factory owners were required to carry out clean-up and post-monitoring of the sites. Besides illegal dumping cases, the Department of Environment is alert to the assessment and clean-up of decommissioned petrol stations.

Realising the importance of dealing with contaminated land, the Department of Environment has created a section in the Hazardous Substances Division to look into this issue. There is a need to develop criteria and standards for contaminated soil in Malaysia. Prior to any formulation of clearer policies and legal limits for soil, it is imperative that a compilation of contaminated soil status be initiated and a set of soil pollution guidelines be drawn up to assist both public and private sectors in managing this problem. Of course, there is also a need to build capacity and capability on the assessment and clean-up methodologies and techniques.

Counter Measures

Illegal dumping of scheduled wastes remains a challenge. From 2001-2005, 90 cases of illegal dumping were detected but only 39 could be prosecuted in the court of law. This is due to the lack of evidence and the nature of the crime. Various measures have been instituted to tackle this environmental crime. These include setting up of an intelligence unit to gather information from individuals and groups to detect and prevent environmental crimes. The assistance of RELA officers was also sought to detect illegal dumping activities and other environmental violations. Audits on waste generators, recyclers and disposal facilities will be carried out in a systematic and regular manner. Special training modules have been prepared and training provided to officers to enable them to conduct their tasks more effectively. The Department of Environment is also reviewing the Environmental Quality Act 1974 amongst others to introduce new provisions to facilitate effective and efficient enforcement of the laws. Stiffer penalties such as mandatory jail sentence especially for illegal dumping of scheduled wastes have been suggested.

Contaminated land is an emerging issue which, if not addressed, may give rise to problems relating to health and safety of users, pollution of surface and ground water and financial implications. Programmes to develop national criteria and standards prior to formulation of dedicated legislation would be undertaken. Experiences in other countries will provide useful guidance and reference to Malaysia in the implementation of these programmes.

Conclusion

The Environmental Quality (Scheduled Wastes) Regulations 1989 have served a purpose in providing the essential regulatory framework on scheduled waste management in Malaysia despite constraints faced in administering the various provisions in the regulations. Based on the experiences gained in the 15 years of enforcing the scheduled wastes regulations, the Department of Environment enacted the Environmental Quality (Scheduled Wastes) Regulations 2005, amongst others to redefine waste categories; to exclude wastes that are not characterised as hazardous; to provide an avenue for special management of wastes; and to improve tracking of wastes.

Waste disposal will not become cheaper. Hence it is prudent for industries to engage in waste minimisation. This could be done through changing the process or the raw material used. If this is not possible, wastes should be reused or recovered. Industries should embark on the use of cleaner technology to eliminate or reduce waste generation. An industry that engages in cleaner technology can be cleaner by reducing hazardous emissions, cheaper by saving money and smarter by conserving resources.

Note: Views expressed are not necessarily those of the Department of Environment.

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Biofuels

Answer to Energy Dependence and Global Warming?

Lately, fossil fuel price in the international markets has been escalating at unprecedented levels. Malaysia too has not been spared. Fortunately the effect of high oil prices has been cushioned by the Government's fuel subsidy. Rapidly rising oil prices and dwindling petroleum supplies have pushed major agricultural producers around the world into the production of green fuels. With petroleum prices hovering at USD 70 per barrel and palm oil prices at RM 1400 per tonne, converting palm oil into biofuel is profitable .

Biofuel is any fuel that is derived from biomass – recently living organisms or their metabolic by-products, such as manure from cows and crop residues. It is a renewable energy resource, unlike other natural resources such as petroleum, natural gas, coal and nuclear fuels. Like coal and petroleum, biomass is a form of stored solar energy. The energy of the sun is "captured" through the process of photosynthesis in growing plants. One advantage of biofuel in comparison to most other fuel types is its biodegradable characteristic. It is thus relatively harmless to the environment, if spilled. Agricultural products specifically grown for use as biofuels include corn and soybeans in United States, flaxseed and rapeseed in Europe, sugar cane in Brazil and palm oil in South-East Asia.

The production of biofuels to replace oil and natural gas is being pursued aggressively, with the focus being on the use of cheap organic matter (usually cellulose, agricultural and sewage waste) for efficient production of liquid and gas biofuels which yield high net energy gain. As the nature of carbon in biofuels is "recently extracted" from atmospheric carbon dioxide by growing plants, burning it does not result in a net increase of carbon dioxide in the atmosphere. Therefore biofuels offer much potential as a method to reduce the amount of carbon dioxide released into the atmosphere by using them to replace non-renewable energy resources.

Biofuels currently come in two forms: ethanol and biodiesel. Ethanol is made using a plant feedstock such as corn, beetroot, sugar beet or sugar cane and fermenting it. It can be used directly in pure ethanol-fired cars or be blended with gasoline at the pump to make "gasohol." Alternatively, ethanol can be combined with isobutylene to create ETBE (ethyl tertio butyl ether). ETBE is less volatile than ethanol and can be blended at the refinery, thereby avoiding the investment needed to allow blending at the pump. Biodiesel is made by combining raw vegetable oil with methanol to make a vegetable oil methyl ester (VOME). This can be used directly as fuel or blended with petroleum diesel.

The depletion of fossil fuels, coupled with the increasing awareness of the importance of environmental protection, has led to concerted and escalating efforts in the search and development of renewable and environmentally friendly alternative energy sources. In Malaysia, Malaysian Palm Oil Board (MPOB) has developed palm methyl ester, a liquid similar to diesel in properties and appearance, which can be used in vehicles like any other fuel. Methyl ester from one acre of oil palms could provide enough fuel for a car to travel an estimated 20,000 km. Malaysia, the world's top producer and exporter of palm oil, is pushing to create a mandatory blending of a certain amount of the oil with retail diesel.

Largely in move to address this problem, the government has announced the introduction of a National Biofuel Policy on 10 August 2005. The policy is primarily aimed at reducing the country's dependence on depleting fossil fuels, promoting the demand for palm oil as well as stabilising its price at a remunerative level. The Malaysian National Biofuel Policy (interchangeably known as the National Biodiesel Policy) entails a four-pronged strategy encompassing:

1. Production of biodiesel fuel blend of 5% processed palm oil with 95% petroleum diesel and known as B5 diesel,
2. Encouraging the use of biofuel among the

public, which will involve giving out incentives for oil retail companies to provide biodiesel pumps at stations,
3. Establishing an industry standard for biodiesel quality, which will be the responsibility of SIRIM, and
4. Setting up of a palm oil biodiesel plant, which is targeted to be built in Labu, Negeri Sembilan.

In the longer term, the National Biofuel Policy will include establishing a national Biofuel Industry Act as well as providing several more incentives.

Malaysia's palm oil industry is the natural and obvious candidate for implementation of any biodiesel initiative. Palm oil has an advantage over other oils and fats in terms of productivity, yield and efficiency and is the most productive oil bearing plant species known. The yield of palm oil per unit area is 5 and 10 times higher than rapeseed and soybean oil respectively. This yield factor alone is adequate for the world to decide which vegetable oil should be produced to meet the expanding requirement for Greener and Cleaner Energy for its growing population and limited land resources. Benefits of using

palm oil as biofuel are several: mitigating the effect of petroleum price escalation, savings in foreign exchange, environment friendly source of energy, new demand for palm oil, mutually beneficial effects on petroleum and palm oil sectors, achieving a socio economic safety net and efficient utilisation of raw materials.

Biofuels have taken on new importance worldwide as countries look to cut their emissions to adhere to the UN Kyoto Protocol. In December 1997, 161 nations met in Kyoto, Japan, to negotiate a treaty to alleviate global warming. The resulting Kyoto Protocol would require 39 developed countries to cut, by 2012, their emissions of carbon dioxide, methane and nitrous oxide to an average of about 5.2% below 1990 levels. The use of biofuel especially in resort areas, marine parks and highly polluted cities is intended to improve air quality.

The development of the biofuel industry is likely to prove rapid as government incentives drive forward what is still only a marginally economic product. There are three reasons behind this: security of supply, climate change targets, and import substitution and new exports. Climate change and energy security priorities have created a policy framework that will produce a rapid expansion of the biofuels market, despite

marginal economics. Biofuels bring energy and agricultural markets into direct competition. While this may serve to keep biofuel production costs high, there are possible policy trade-offs between agricultural subsidies and biofuel incentives.

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Activity Highlights
Department of Environment, Malaysia

August 2006

ASEAN Working Group Meeting on Sub-Regional Fire-fighting Arrangements (SRFAs) for Sumatra and Borneo

The 19th Joint Meeting of the ASEAN Working Group on Sub-Regional Fire-fighting Arrangements (SRFAs) for Sumatra and Borneo was held in Kuala Lumpur from 21 – 22 August 2006. Hosted by the Department of Environment of the Ministry of Natural Resources and Environment, Malaysia, the Meeting discussed updated reports on fire and haze occurrences in the ASEAN region and forecast of meteorological conditions for the region by the ASEAN Specialised Meteorological Centre (ASMC); deliberated on preventive measures and dry season preparedness by all the SRFA Member Countries; operationalisation of Standard Operating Procedures for Monitoring, Assessment and Joint Emergency Response and the Operationalisation of Procedures of the Panel of ASEAN Experts on Fire and Haze Assessment and Coordination; and took note of a recently conducted SRFA Fire and Haze Disaster Simulation Exercise. Forty delegates from Brunei Darussalam, Indonesia, Malaysia, Singapore, Thailand, the ASEAN Secretariat and international agencies attended the Meeting.

September 2006

2006 Malaysia Environment Week (MASM 2006)

The 16th Malaysia Environment Week, with the theme ‘Environmental Conservation, Our Shared Responsibility’, was held from 12-18 September 2006 at Kangar, Perlis. The theme not only calls for public and community involvement but also commitment to protect and preserve our beloved environment. The Malaysia Environment Week (MASM 2006), a premier event in the diary of the Department of Environment, is held annually to instill environmental awareness among Malaysians.

YAB Menteri Besar Perlis, Dato’ Seri Shahidan bin Kassim officiated at the launch of MASM 2006. In conjunction with the ceremony, the 2006 Langkawi Award, the most prestigious environmental award conferred on a Malaysian individual for significant contribution to the environment, was presented to Mr. Bishan Singh, an ardent advocate of environmentally sustainable development in Malaysia. Amongst his significant contributions was the ‘Save Chini Lake Campaign’, which succeeded in generating much public awareness on the importance of preserving the nature and ecological system of Lake Chini. The recipient received a commendation signed by the Yang di-Pertuan Agong of Malaysia, a plaque from the Minister of Natural Resources and Environment as well as RM 10,000 in cash.

Upcoming Events

4th ASEAN-OSPAR Management Meeting

The 4th ASEAN Oil Spill Preparedness and Response (OSPAR) Management Meeting will be held from 14 to 16 November 2006 in Pulau Langkawi, Kedah. The meeting will be attended by delegations from ASEAN-OSPAR member countries and Japan (as observer). In conjunction with the meeting, a one-day seminar on Hazardous Noxious Substance (HNS) will be held on 16 November 2006.

For further enquiries, please contact parimala@doe.gov.my.

Forthcoming Issues

ISSUE 3 : Read all about life-sustaining **Water Resources** of the nation including pollution, protection, management and the disasters we can bring upon ourselves from poor management of this vital resource.

ISSUE 4 : How well does the public understand environmental issues and concerns? What has been done and what more needs to be done? Read all about **Environmental Education and Awareness** and more in this issue.

Article contributions and comments are welcomed. They are to be directed to:
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