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Rich People, Poor Earth?

# Malaysian Farm Certification Scheme for Good Agricultural Practices

**There is a growing consensus that industrial agriculture has severe shortcomings for the 21st century. Although it has been successful in increasing output over the years, the harm to the environment and public health is increasingly being realised, not just by consumers, but by producers themselves. The sustainability of industrial agriculture is seriously being questioned and we need to seek an alternative approach to the way we produce our food.**

The sustainable agriculture initiative is not just an option to industrial agriculture, it is an imperative. It does not mean that we are de-emphasising production in favour of the environment – but protecting the environment is the only way to ensure that future food needs can be met. It also does not mean that we ought to return to past practices – it is the recognition that industrial agriculture must be modified to meet standards of sustainability.

It is widely accepted that the demand for sustainability has been initiated at the general consumer level. Thus producers should be aware of the concept of consumer rights and how consumers view product attributes. This is highlighted in the section following this introduction. This is followed by a short review of Good Agricultural Practices (GAP). The third section then considers the issue of Malaysian Standards, in particular the Malaysian Farm Certification Scheme for GAP.

## Consumer Rights and Product Attributes

Issues concerning consumer rights are not exactly new. In a 1962 address to the US Congress, US President Kennedy declared the four basic consumer rights: right to safety, right to be informed, right to choose and the right to be heard. Consumers International, a global federation of consumer organisations, of which Malaysia is a member, has added to these original four another set of consumer rights: right to satisfaction of basic needs, right to redress, right to consumer education and right to a healthy environment.

Higher income, urbanisation, demographic shifts, improved transportation and changing consumer perceptions on quality and safety have contributed to a shift in product quality and ethics in consumption, including a concern for the environment. Consumers are hardly to be blamed as there has been increasing incidents of food contamination, including pesticides and microbial contamination, bird flu outbreaks, mad cow disease, etc.

Not too long ago, discussions among producers and even economists, have focused on the possibility of product quality requirements imposed by importing countries as a form of non-tariff barrier to trade. Rather than dwell on motivations, which are hard to discern, it is more worthwhile to look at these requirements as a natural progression of the greening market system. This is much more evident in recent years as even within the domestic market, consumers are beginning to exert their rights with respect to product quality.

JABATAN PERTANIAN

SKIM AMALAN LADANG BAIK MALAYSIA

The underlying reason for consumption is that consumer products possess a set of attributes that give utility to consumers. For food products, most are familiar with physical product attributes such as colour, size, taste and texture. Another set of attributes that is valued by consumers refers to the production process itself. These are thus called process attributes. A clear example is the requirement by Muslims as to how the animal is slaughtered. More and more consumers are now interested in how the animals have been treated in the production process. Thus whether the animals are allowed to roam in the free range system or confined to feedlots and cages is important to some consumers. Whether child labour was

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From the desk of the Director General

# Rich People, Poor Earth?

**Of the many tales and stories of our childhood, there is one which comes to mind immediately as a morality tale with regard to the environment. Perhaps even a cautionary one. The heroic and well loved story of the little Dutch boy springs to mind. Though cold and wet, Jan the Dutch youngster was steadfast through the night in plugging the leak in the dyke with his mere finger, thus saving a town and a nation from certain disaster. Can we all afford not to emulate this kid to stem the tide of environmental disaster that will surely befall our poor Earth if we do not act?**

Surely we can exhibit in some way the foresight, courage and fortitude of Jan. We can start by relooking the very fundamental and basic aspects of our economy. And what can be more basic than food, shelter and clothing. In this issue of Impak, we have focused on the greening of two of these basic needs - food and shelter.

Come April 2009, Malaysia will launch a rating system for buildings called the Green Building Index (GBI). It is a profession-driven initiative and that makes it all the more laudable. It is intended to promote sustainability in the built environment and raise environmental awareness among developers, architects, engineers, planners, designers, contractors and the public. The GBI incorporates internationally recognised best practices in six key areas viz Energy Efficiency, Indoor Environmental Quality, Sustainable Site Planning and Management, Materials and Resources, Water Efficiency and Innovation. Many of the above criteria can of course be related to Jan's heroic act on that cold, wet night in Holland. His use of himself was Energy Efficient and surely the use of his finger was Innovation itself!

There is no one single technique for designing and building a green building. But buildings that are 'green' often have common design characteristics. Like, preserving natural vegetation, using non toxic or recycled building materials, being readily accessible to public transportation, use of natural lighting and the flexible use of interiors to name a few characteristics. Speaking of which, do look out for two notable green buildings in the Klang Valley - the Securities Commission headquarters in Kuala Lumpur and The Ministry of Energy, Water and Communications low energy office in Putrajaya. Such efforts and achievements strongly indicate that we can indeed seek environmental shelter by going green.

Now as to food, there is growing consensus that industrialisation of agriculture has led to severe harm to both the environment and public health. As a production tool, industrialisation of the farm has been a success. But the questions of the day are : Is it sustainable? Can industrialisation of the farm ensure that future food needs be met? No one is suggesting we go back to the Middle Ages. There is, however, a need to modify many of our current agricultural practices that are clearly unsustainable. And since food is, like shelter, a vital and basic need, the issue of sustainability is consumer driven. That is, agricultural production cannot escape the watchful scrutiny of millions of eyes. These millions of eyes are looking after eight rights as invoked by Consumer International, a global federation of consumer organisations. These are the right to safety, right to be informed, right to choose, right to be heard, right to satisfaction of basic needs, right to redress, right to consumer education and *right to a healthy environment*. And rightly so!

Therefore with regard to food originating as agricultural produce, Good Agricultural Practices (GAP) are deliberately linked to consumer rights and both product and process attributes through the Malaysian Farm Certification Scheme (SALM). Launched in 1992, it is now supported by MS 1784 : 2205 Crop Commodities - GAP launched in December 2005. There are some 20 elements to be observed in three major groupings. These are (i) Environmental Setting of the Farm, (ii) Verification of Farm Practices and (iii) Safety of Farm Produce. It must also be noted that SALM incorporates elements of traceability and welfare of workers. These are indeed useful initiatives!

We started off with the story of Jan, the very responsible youngster. We end by taking note of an irresponsible one – 'The Boy Who Cried Wolf'. Most assuredly we are not crying 'wolf' by raising environmental concerns, issues, predictions and fears over these past years. They are for real. What is important now is to realise, like Jan, that beyond the tipping point, there will be little left to save.

**Dato' Hajah Rosnani Ibarahim**
Director General
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used in the production process is another criterion of increasing importance. The place of production can also be an important attribute for consumers as was the case immediately after the Chernobyl disaster when milk and milk products from production areas far from the disaster area such as New Zealand and Australia were preferred by Malaysian consumers.

Product attributes can also be classified as to whether they can be easily ascertained by consumers. Those that can be determined at time of consumption, such as taste and odour, are referred to as experience attributes. Many attributes within the process attribute class are not easily determined by consumers. Since most abattoirs are far removed from consumers, it is hard for consumers to determine whether or not the animal was slaughtered according to Islamic requirements. The presence of feed additives or other ingredients such as colouring agents, and nutritive value of food products are much harder to be determined by consumers. These characteristics are called credence attributes.

Since consumers cannot determine process and credence attributes easily, they depend on extrinsic indicators such as labels and certificates from quality assurance schemes. The Halal logo for meat products and Dolphin-Safe logo on tuna cans are two good examples.

## Quality Assurance Schemes and Traceability

The safety assurance system such as Hazard Analysis Critical Control Point (HACCP) is quite difficult to implement on the farm. There are basically two streams of development in GAP. The first is Euro-Retailer Produce Working Group Good Agriculture Practices (EurepGAP) developed after the mad cow disease scare in 1997 by Euro Retailer Produce Working Group. It is committed to (a) maintaining consumer confidence in food quality and safety; (b) minimising detrimental impact on the environment while conserving nature and wildlife; (c) reducing use of agro-chemicals; (d) improving the efficiency of natural resource use; and (e) ensuring responsible attitude towards worker health and safety.

The other stream is developed in the US which began with a directive from President Clinton leading to the Food and Drug Administration/ United States Department of Agriculture publication in 1998 'Guidance for Industry - Guide to Minimize Microbial Food Safety Hazards for Fresh Fruits and Vegetables'. Distinct from EurepGAP, the focus of the US scheme is in preventing microbial contamination of fresh produce.

While assuring quality in terms of scientifically evaluated characteristics can be a prerequisite to consumer confidence, it does not follow automatically that consumer confidence can be built without further information. Labeling is usually considered the best tool to provide such information. Closely related to labeling is the concept of traceability.

EurepGAP defines traceability as "the ability to retrace the history, use or location of a product (that is the origin of materials and parts, the history of processes applied to the products or the distribution and placement of the product after delivery) by means of recorded identification." In the US, there is no direct mention of traceability but the Perishable Agricultural Commodities Act (PACA) mentions "the ability to identify the source of a product can serve as an important complement to good agricultural and management practices intended to minimise liability and prevent the occurrence of food safety problem."

GAP and traceability are two distinct systems and in the opinion of some, too complicated to be developed into an integrated system. Both systems need to be developed independently. Note that the traceability system neither assures safety nor detects the source of contamination. However, the system is a good system to communicate, but in itself, does not assure safety.

## Malaysian Standards

STANDARDS MALAYSIA (SM) was established in August 1996 by the Standards of Malaysia Act 1996. Formerly known as the Department of Standards Malaysia (DSM) till November 2006, it is currently placed within the Ministry of Science, Technology and Innovation (MOSTI). The Minister is advised by the Malaysian Standards and Accreditation Council (MSAC), of which the Director General of STANDARDS MALAYSIA is an ex-officio member.

SM appoints certification bodies (CB) to handle all matters pertaining to standards. SIRIM QAS International Bhd is the first CB accredited firm (in 1996) by SM for Quality Management System (QMS). To date there are 11 CBs for QMS and eight CBs for Environmental Management System (EMS). Other Accredited Certification Body (ACB) schemes are Product Certification Systems, Occupational Safety and Health Management Systems, HACCP Based Food Safety Systems, Information Security Management Systems, Forest Management Certification, Food Safety Management Systems and Certification of Persons.

As of 31 December 2008, there are 5518 standards divided into 23 sectors. The sectors include Agriculture (578 standards), Chemicals (713), Power Generation, Transmission and Distribution of Electrical Energy (776) and Information Technology, Telecommunication and Multimedia (653).

STANDARDS MALAYSIA

## The Malaysian Farm Certification Scheme for Good Agricultural Practices (SALM)

SALM is a certification scheme launched in 1992 and implemented by the Department of Agriculture Malaysia. It is now supported by MS 1784:2205 Crop Commodities - GAP launched in December 2005. SALM is derived from EurepGAP for Fruits and Vegetables and refers to specific legal provisions of national laws such as the Environmental Quality Act 1974 and its Regulations thereunder; Pesticides Act 1974; Food Act 1983 and Food Regulations 1985.

There are three major aspects to the evaluation of farms with a total of 20 elements to be observed:

1. Environmental setting of farm which covers the seven elements of (i) legality of farm, (ii) altitude above mean sea level, (iii) previous use or history of farm, (iv) slope and terrain of farm, (v) soil erosion risk factor, (vi) source and quality of irrigation water and farm use, and (vii) source and distances from pollution centers.

2. Verification of farm practices with ten elements of farm records of activities undertaken: (i) soil and substrate preparation and management (including soil fumigation); (ii) selection of planting (variety, root stock, clones etc.); (iii) crop nutrition or fertiliser programme; (iv) crop pest management system (pesticides usage, Integrated Pest Management, etc.);

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(v) harvesting techniques and field transport; (vi) post-harvest treatment, grading and packaging; (vii) storage of farm inputs and products; (viii) farm waste disposal system; (ix) farm workers' legal status; and (x) welfare and safety training of farm operatives.

3. Safety of farm produce with three elements: (i) physical quality of produce such as appearance, infestation from pests and taste; (ii) levels of pesticide residue in the produce; and (iii) contamination of heavy metals such as arsenic, lead, mercury and cadmium.

The rules are classified into MUST and ENCOURAGED. MUST rules are related to critical elements which must be complied with. These are further divided into MAJOR MUST rules which are related to elements with severe impacts and MINOR MUST, that is, those with not so severe impacts. ENCOURAGED are those which are recommended and associated with elements that are minor or not sufficiently severe to impact the environment.

Table 1 shows the major headers in the table of elements. There are altogether 29 MAJOR MUST, 76 MINOR MUST and 56 ENCOURAGED elements. The full table can be accessed at the Department of Agriculture (DOA) website. As of 2007, 211 SALM certificates had been awarded.

Table 1: Elements and levels in SALM.

| Elements | Major Must | Minor Must | Encou-raged | Total |
|---|---|---|---|---|
| Traceability | 1 | 0 | 0 | 1 |
| Record Keeping and Internal Audit | 3 | 4 | 0 | 7 |
| Planting Materials and Root Stocks | 2 | 3 | 5 | 10 |
| Site History and Site Management | 4 | 4 | 1 | 9 |
| Soil and Substrate Management | 1 | 3 | 5 | 9 |
| Fertiliser Management (Organic and Inorganic) | 2 | 13 | 9 | 24 |
| Irrigation and Fertigation | 1 | 1 | 7 | 9 |
| Crop Protection | 7 | 27 | 10 | 44 |
| Harvesting | 0 | 7 | 1 | 8 |
| Post-harvest Handling | 5 | 4 | 2 | 11 |
| Pesticide Residue Analysis of Produce | 1 | 1 | 3 | 5 |
| Waste and Pollution Management, Recycling and Reuse | 0 | 0 | 4 | 4 |
| Workers' Health, Safety and Welfare | 1 | 6 | 7 | 14 |
| Environmental Issues | 0 | 2 | 2 | 4 |
| Record of Complaints | 1 | 0 | 0 | 1 |
| Legal Requirements | 0 | 1 | 0 | 1 |
| **Total** | **29** | **76** | **56** | **161** |

## Conclusion

This article has reviewed the physical as well as process attributes of products that provide value to consumers. Together with the shifts in income and demographics, these factors have increased the demand for agricultural quality assurance schemes such as SALM to ensure sustainability in food production. Besides the classification of physical and process attributes, product characteristics can be grouped as experience and credence attributes. For process and credence attributes, consumers depend on extrinsic cues such as labeling to make decisions regarding consumption. Labeling and traceability provide information to consumers that are crucial to consumer confidence.

SALM is based on EurepGAP with three major aspects evaluated; the environmental setting of the farm, verification of farm practices and safety of farm products. It should be noted that SALM also incorporates traceability and worker welfare within the rules or protocols required.

Although SALM attempts to incorporate both food safety and environmental issues, further integration could be achieved by other approaches such as Life Cycle Assessment (LCA). Applications of LCA in agriculture can clarify the relationship between agricultural intensity and the environmental impact.

Another area of improvement concerns traceability. Many food products change form along the supply chain. A comprehensive traceability system should identify every food item and its raw materials all along this chain and not just on the farm. SALM, however, is a good step in the right direction.

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# Brick and Mortar: Towards Greener Buildings

Although the way that we design and build homes has evolved through many cycles, a strong sense of the environment remain critical in the construction of homes that are both practical and good-looking. This is similar to good fashion sense, which stays fresh and vital all the time, in spite of the fashion trends that come and go.

In the West, for example, many architects and designers are coming back full circle to adopt greener methods of construction, in both methods of building and choice of material used. This reflects an increasing awareness towards the environment, a trend that has been gaining ground in the last few years.

Throughout the world, people are paying more attention to sustainable and green initiatives. In the United States, President Barack Obama has vowed to go green, pledging USD15 billion a year in renewable sources of energy to create five million new energy jobs over the next decade– jobs building solar panels and wind turbines and a new electricity grid, he says. His 'go green' policy will have a major impact on housing and the way that houses are built in future.

Over in China, the Shanghai Tower, destined to be the country's tallest building upon completion in 2014, will also boast many green elements. The mammoth complex comprising offices, residences, retail units and hotel will feature a rain water recycling system, a series of wind turbines to harness wind power and no fewer than nine sky gardens.

At home, the *Pusat Tenaga Malaysia* Zero Energy Building in Bangi, Selangor, is a pilot project that combines energy efficiency and renewable energy in the first working building of its kind in Asia. Back in March 2007, our Prime Minister launched the Malaysian Green Building Mission, aimed at raising awareness and promoting sustainable building and construction in the country.

## What's next for developments wanting to go green in Malaysia?

Firstly, benchmarks and rating tools are needed to guide all involved parties towards achieving environmentally responsible buildings. Many countries have introduced guidelines and assessment methods on whether or not a building can be classified 'green'.

For example, the UK established Building Research Establishment Environmental Assessment Method (BREEAM) in 1990, the US has Leadership in Energy & Environmental Design (LEED), set up in 1996, while other countries such as Canada, Japan, Taiwan, Australia, Hong Kong and Singapore also have their own guidelines to green buildings.

In January this year, Malaysia Institute of Architects (PAM) and Association of Consulting Engineers (ACEM) initiated a Green Building Index (GBI) – our first – meant to guide architects, designers, engineers and property developers in Malaysia towards constructing greener buildings. The Index provides an assessment of the various categories involved in green buildings; including energy and water efficiency, indoor environmental quality, sustainable site management and innovation; and based on these criteria, generates a green rating for the building. Details of the GBI are given in the article that follows.

This initiative forms an excellent start and provides property developers with clear guidelines for achieving environmentally-friendly buildings. However, as it has just been introduced, it will be some time before the guidelines are adopted by the government and fully enforced. In Singapore, for example, while the Green Mark was introduced in 2005, the compulsory adoption of certain criteria was not enforced until 2008.

There are also other factors to consider before we can adopt 'green' fully. It would be necessary to educate all parties involved. This will be a long-term effort and will need to be done in a systematic way. For example, if a green feature such as a green roof is to be incorporated into a building, the contractors would need to have the skills to build it, while the developers would need to know how to maintain it in the long term. The public, too, would need to understand the benefits of living or working in a green building.

Another issue is cost. Green buildings cost more to construct and maintain. Solar panels, which can be used to heat water, for example, are still relatively expensive compared to water heaters that run on electricity. This means that as developers will have to incur more cost when developing a green building, purchasers will have to pay more to buy a green building as well as allocate extra maintenance fees in the long term.

In order to make it more attractive all round and accelerate the development of green buildings, the government should introduce some financial incentives, not unlike those in Singapore, where the government has set aside S$20 million to reward developers, building owners, project architects and Mechanical & Electrical engineers who make extensive use of green building technologies.

In the meantime, developers should take steps to incorporate green elements into buildings wherever possible. As a start, we can make our houses more environmentally-friendly by making sure that they have efficient layouts. Generous, airy spaces that are not hindered by columns or dead corners are ideal.

Energy efficient homes emulate nature. They are designed to take advantage of the environment in which they are located and to respond to the climate. Every small step in the quest to go green is important.

While we as property developers strive to ensure that our homes are well-lit, well ventilated and efficiently designed, home owners, too, can take small steps to reduce energy consumption in their homes. Any effort in this direction – from using energy saving bulbs to reducing the use of air-conditioners and being careful with water consumption – is beneficial for the environment and helps with the pocket, too!

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# Green Building Index Malaysia

The Ministry of Energy, Water and Communications low energy office building, Putrajaya

**The Green Building Index (GBI) Malaysia is a profession driven initiative to lead the Malaysian property industry towards becoming more environment friendly. It is intended to promote sustainability in the built environment and raise awareness among developers, architects, engineers, planners, designers, contractors and the public about environmental issues. Developed by the Malaysian Institute of Architects (PAM) and the Association of Consulting Engineers Malaysia (ACEM), the GBI Malaysia incorporates internationally recognised best practices in environmental design and performance that will serve to promote environment-friendly buildings for the future of Malaysia.**

GBI Malaysia is a benchmarking rating system that provides a comprehensive framework to evaluate the environmental impact and performance of buildings based on the six key criteria of Energy Efficiency, Indoor Environmental Quality, Sustainable Site Planning and Management, Materials and Resources, Water Efficiency and Innovation. Buildings will be awarded GBI Malaysia Platinum, Gold, Silver or Certified ratings depending on the scores achieved.

## Act Now

It is no more a matter of WHY we need to build green but rather HOW we can build green and it should be starting NOW. The effects of global warming (GW) cannot be unknown. GW has been attributed to the Ozone Hole, the gradual rise in the earth's temperature and the greenhouse effect. A frightening statistic is that temperatures in the far north have increased 5˚C to 7˚C in the last 50 years, and as the temperatures get warmer, the sea level rises causing a difference in the amount of precipitation. This in turn causes extreme weather conditions resulting in excessive storms with heavier rainfall. The ecosystem is then affected resulting in changing agricultural growth and harvest yield, leading to extinction of certain animal and plant species.

The main greenhouse gases (GHG) is $CO_2$, methane and water vapour. While water vapour and methane are not present for very long in the earth's atmosphere, $CO_2$ can remain in the atmosphere for many years and when combined with the water vapor can escalate the rate at which GW takes place. Therein lies the need to stop GW by removing $CO_2$ present in the atmosphere or at least not add more to it. The Montreal Protocol and Kyoto Protocol are aimed at arresting or at least mitigating this man-made disaster.

So what can we do about GW? Plenty! We can reduce consumption of energy to decrease GHG, starting by reducing the use of electricity. It is amazing to know that about 11% of electricity is consumed by phantom loads alone. We are ready and have the capacity to use more efficient light bulbs. For instance, in USA alone, if every household were to apply a compact florescent bulb instead of a glowing light bulb, we can realise a staggering reduction of 90 billion pounds of $CO_2$ emission!

In terms of climate change, apart from the great financial impacts, the human impact is already being felt. Millions are starving throughout the globe, and with the world's population increasing steadily, the situation will only continue to deteriorate if temperature and climate change are allowed to continue unimpeded.

Global GHG emissions have increased by 70% between 1970 and 2004 and the largest growth of this emission has come from the energy supply sector. So where do we stand locally? Malaysia's population grew at a rate of about 2.8% from 23 million in 2000 to 27 million today. Rising population and changes in life style have accelerated the demand for energy. The Malaysian energy sector is still heavily dependant on non renewable fuels which are finite, deplete gradually and contribute significantly to GHG emission.

## What is Meant by Building Green?

A Green or Sustainable Building is one which is designed:

- to save energy and resources, recycle materials and minimise the emission of toxic substances throughout its life cycle,
- to harmonise with the local climate, traditions, culture and the surrounding environment, and
- to be able to sustain and improve the quality of human life while maintaining the capacity of the ecosystem at the local and global levels.

Building Green in the future is a necessity and not an option as the following statistics will attest:

- Buildings consume 40% of our planet's materials and 30% of its energy.
- Construction of buildings uses up to three million tonnes of raw materials a year and generates 20% of the solid waste stream.

Therefore, if our urban future is to survive, there is no option but to build in ways which improve the health of ecosystems. Understanding the concept of ecological sustainability and translating it into practice as sustainable development is a key challenge for today's built environment professionals.

> ***"The skill and vision of those who shape our cities and homes is vital to achieving sustainable solutions to the many environmental, economic and social problems we face on a local, national and global scale"***
>
> *Peter Graham*

## How to Build Green?

The term 'Green Building' is a loosely defined collection of land-use, building design, and construction strategies that reduce the environmental impacts that buildings have on their surroundings. Traditional building practices often overlook the inter-relationships among a building, its components, its surroundings, and its occupants. Typical buildings consume more of our resources than necessary and generate large amounts of waste. Green buildings offer several benefits: better use of building resources, significant operational savings, and increased workplace productivity. Building green sends the right message about a company or organisation - that it is well run, responsible and committed to the future.

There is no single technique for designing and building a green building, but green buildings often have the following elements:

- Preserve natural vegetation
- Contain non-toxic or recycled-content in building materials
- Maintain good indoor air-quality
- Use water and energy efficiently
- Conserve natural resources
- Feature natural lighting
- Include recycling facilities throughout
- Include access to public transportation
- Feature flexible interiors
- Recycle construction and demolition waste

## Who are Involved in Green Buildings?

A truly green building can only materialise and thereafter sustain itself when all parties are involved in its birth. Obviously the starting point is the particular piece of land on which the building will stand. Hence, it starts with the owner/developer who will probably consult the advice of the relevant experts which includes the professional architect or engineer (as the case maybe). It is at this stage that issues such as developing on a protected green lung, brown field and green field are relevant and decisive on achieving a green building.

After the initial hurdle (which includes the social impact assessment) is successfully (and greenly) navigated, the design team will next play its role. From there on, the need to strike a balance between the 'company's green policy', value engineering, life cycle cost etc. will determine the success or otherwise of the project.

Nowadays, when we talk about green buildings, the project team (helmed by the owner) will have to determine which Green Building Rating System to adopt. There is no right or wrong tool but rather the most appropriate tool to choose from. All green rating tools incorporate basically similar criteria of assessments (albeit with differing weightings) and these criteria require the entire team's participation. For instance, the owner will have to agree to pay to save the environment and commit that the end users will procure energy efficient appliances. The designers will need to write into the contract conditions for the builder to undertake the protection of the environment (in terms of air and waste pollution) at commencement of construction. Vendors have to supply products that are environment friendly and so on. Figure 1 summarises this integrated approach to achieving green.


Figure 1: Integrated approach to achieving green building design and construction.

Table 1: Comparison of the Green Building Index Malaysia with other selected tools.

| Name | LEED | GREEN STAR | GREEN MARK | GREEN BUILDING INDEX |
|---|---|---|---|---|
| Country Year | USA 1996 | Australia 2003 | Singapore 2005 | Malaysia 2009 |
| Assessment Criteria | 1. Sustainable Site<br>2. Water Efficiency<br>3. Energy and Atmosphere<br>4. Materials and Resources<br>5. Indoor Environmental Quality<br>6. Innovation and Design / Construction Process | 1. Management<br>2. Transport<br>3. Ecology<br>4. Emissions<br>5. Water<br>6. Energy<br>7. Materials<br>8. Indoor Environmental Quality<br>9. Innovation | 1. Energy Efficiency<br>2. Water Efficiency<br>3. Environmental Protection<br>4. Indoor Environmental Quality<br>5. Other Green Features | 1. Energy Efficiency<br>2. Indoor Environmental Quality<br>3. Sustainable Site and Management<br>4. Materials and Resources<br>5. Water Efficiency<br>6. Innovation |

Table 2: Proposed levels of Green Building Index Rating and projected Building Energy Intensities and energy savings.

| | Average Malaysian Building | Meets MS1525 | GBI Certified | GBI Silver | GBI Gold | GBI Platinum |
|---|---|---|---|---|---|---|
| BEI kWh/m²/year | 250 | 200 - 220 | 150 - 180 | 120 – 150 | 100 - 120 | <100 |
| Energy Savings % | Base | 10 - 20 | 30 - 40 | 40 -50 | 50 – 60 | > 60 |

## Green Building Rating Tools

### *Advent of Green Tools*

In 1990, the Building Research Establishment of United Kingdom came out with the first Green Building Rating Tool or Assessment Method called BREEAM based on nine criteria: (i) Management, (ii) Health and Comfort, (iii) Energy, (iv) Transportation, (v) Water Consumption, (vi) Materials, (vii) Land Use, (viii) Ecology, and (ix) Pollution. This was quickly followed by other countries, and in the past year or so, this awareness has finally come to Malaysia's shore.

### *Green Building Index Malaysia*

PAM/ACEM began developing the GBI Malaysia in August 2008 and is set to launch the rating system in April 2009. Table 1 shows the assessment criteria for the GBI Malaysia vis-à-vis those of LEED, Green Star and Green Mark.

Table 2 shows the proposed four levels of GBI Malaysia rating system and their projected Building Energy Intensities (BEI) and energy savings. Already some buildings in Malaysia have achieved the BEI of the proposed Green Building Index Rating. For example, the Securities Commission Headquarters Building in Kuala Lumpur has an estimated BEI of 120 kWh/m²/year and was the winner of the ASEAN Energy Award 2001. Another notable green building is the Ministry of Energy, Water and Communications low energy office building at Putrajaya with a BEI of 100 kWh/m²/year and which bagged the ASEAN Energy Award 2006.

## Conclusion

As the world's population continues to grow and the need for more food, comforts and luxuries increases, we must learn to do more with less energy and materials. We must begin developing alternative and renewable energy sources. We must also learn to turn our garbage into a resource. Today's designers have to develop a "cradle to grave" attitude in their designs. By thinking initially about the full life-cycle of a product and how it might ultimately be re-used, designers and in particular, engineers can make great strides in helping to close the energy and environmental cycles. The building industry has served mankind extremely well in terms of offering comfort, convenience and the like. Now it needs to be at the forefront of this Green effort.

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# Towards Sustainable Development: Management of Household Hazardous Wastes

All homes generate not only general solid wastes but also other wastes that are hazardous in nature. These wastes can harm human health and the environment if improperly handled. These 'household hazardous wastes' (HHW) are normally leftovers of household products used in cleaning, home improvements, automobile maintenance, lawn and garden care, hobbies, and a variety of other activities. The HHW contain potentially hazardous ingredients which require special care in terms of handling and disposal.

Statistics show that in the United States, thousands of people are injured by exposure or accidents caused by HHW. Because of the dangers they pose, the HHW needs to be managed properly. Improper management of HHW includes pouring the HHW down the drain, on the ground, into storm sewers, or in most cases discarding them together with other general solid wastes.

In Malaysia, there is no regulation enforced on proper management of HHW at the moment. Knowledge on HHW is still low among the citizens, and proper management of HHW is still beyond our reach. With the enactment of the new Solid Waste and Public Cleansing Management Act (2007) that regulates household wastes and the long existing Environmental Quality Act (1974) that regulates hazardous wastes (scheduled wastes), it is probably timely now to find an effective and sensible way for proper management of HHW in Malaysia, in order to complement our move towards sustainable development and 2020.





## What is Household Hazardous Wastes?

It is a common perception that hazardous wastes are an outcome of industrial activities or emanate from other special places such as laboratories. In actual fact, a wide range of consumer products that contain hazardous components are being used in every household. These include batteries, fluorescent tubes, insecticides, mercury thermometers, paints, agriculture chemicals and even used computers or old television sets etc.

In general, HHW has at least one of the following characteristics:

- Toxic - Poisonous or causes long-term illness (such as cancer). Pesticides, paint thinners, many auto products and some cleaners are toxic.
- Flammable - Burns easily. Paints, thinners and other solvents and auto products are the most flammable home products.
- Corrosive - Eats through materials (acid, for example). Oven cleaners, drain cleaners, toilet bowl cleaners and auto batteries are common corrosive products.
- Reactive/Explosive - Can spontaneously ignite or create poisonous vapours when mixed with other products, or can explode when exposed to heat, air, water or shock. Fortunately, there are only a few consumer products in the market that are explosive (except for fireworks).

## Danger of Household Hazardous Wastes

According to the United States Environmental Protection Agency (USEPA), Americans generate about 1.6 million tonnes of HHW per year and the average home can accumulate as much as 45kg of HHW in the household at anytime. Collectively, the quantity is huge and these materials can create serious health and safety risks or contaminate our groundwater, surface waters or the air we breathe if they are not managed properly.

The improper management of HHW can cause severe problems for the entire community and ecosystem in terms of both human health and environmental impacts. Some HHW such as gasoline, thinners, lighter fluid or glues and adhesives are flammable and can catch fire easily. Others, such as pool chemicals and bleaches, can react violently with other materials to explode or produce toxic gases. On the other hand, lawn and garden or agricultural chemicals, can be toxic if inhaled or ingested perhaps causing cancer, birth defects or other serious medical problems.

It has also been reported that sewers have exploded and waste collection trucks have burst into flames because people carelessly discarded flammable or reactive wastes mixed with other general solid wastes. HHW can also leak from the disposal site and contaminate groundwater and surface water or even can enter the air we breathe through emissions from landfills or open burning. The World Health Organization (WHO) in particular, has been concerned about the tremendous increase in electronic and electrical wastes (e-wastes), which is also a type of HHW and requires special handling. In addition, HHW such as paints and stains leaking from waste bins or the back of waste collection trucks may not be dangerous, but can be a public nuisance and a community eyesore on roadways and sidewalks.

Used batteries.

## What Can You Do About Household Hazardous Waste?

Each person has options available for proper management of HHW. They are: reducing their dependency on hazardous materials, using less of such materials, and careful disposal of the waste after use. The following are some general guidelines for an individual or a household to contribute towards proper HHW management:

### *Read the Label*

Some hazardous materials indicate proper disposal techniques on their labels. If disposal directions are not present on the label of a material known to be hazardous, the label will indicate contents, solubility, or corrosive/ reactive potential through warnings or cautions on the container. Some examples of the warnings include the following:

- "Wear gloves" is a sign of corrosive or dermally toxic substances.
- "Do not store near heat or open flame" indicates ignitability or reactivity of the materials.
- "Use only in well ventilated room" is normally used for toxic fumes and reactive chemicals.

These clues on the label will present a wise consumer with information necessary for proper management of the material.

### *Reduction at Home*

The best way to reduce is not to generate the hazardous waste in the first place. Always consider reducing your purchase of products that contain hazardous ingredients. Learn about the use of alternative methods or products without hazardous ingredients for some common household needs.

- ✓ When you buy, buy only what you really need.
- ✓ Try to find a non hazardous or less hazardous substitute.
- ✓ Try to select the least hazardous product which will work for you.

### *Use and Reuse as Much as Possible*

When it is not avoidable, try to use and reuse it as much as possible. Often, there's just that 'little bit' left over from a job and it does not seem to be enough to bother saving. We should always try to use all of any hazardous material, or give it to some other people who might need it. Some solvents and cleaners (such as paint thinners) can be stored in a covered jar or container for future reuse.


Samples of household hazardous waste.

Some HHW are recyclable such as car batteries and electronic wastes. In some countries, motor oil and fuel oils are collected for filtering and reuse. HHW should never be mixed with other products because incompatible products might react, ignite, or explode, and contaminated HHW might become non recyclable.

### *Proper Storage and Disposal*

HHW are too dangerous to be simply poured down the drain or placed into a waste bin mixed with other general solid wastes. Some guidelines for proper disposal of HHW are as follows:

- Store products containing hazardous substances carefully to prevent any accidents at home, and never remove the labels.
- Never burn or dump any HHW on the ground. Avoid burying any containers or leftover HHW.
- Do not dispose of any hazardous material 'down the sink'.
- Do not mix HHW with other general solid wastes for disposal.
- Solidify any liquid waste by using an absorbent material (sawdust, paper towels, rags) to soak up the liquid hazardous material.
- With aerosol cans, turn the container upside down and depress spray button, with nozzle facing paper toweling, rags or any absorbent surface, to remove the pressure before disposal.
- Pesticides, herbicides, oil paints, paint cleaners, and oil and transmission fluids should never be flushed into any water system or disposed off on the ground or discarded together with other general solid wastes.

## Issues of HHW Management in Malaysia

While many countries have already enforced mandatory segregation and collection of HHW from the generation sources, there is still no proper and clear regulatory and institutional framework in place for HHW management in Malaysia. Knowledge and awareness among the public on HHW is extremely low. Much of the HHW is therefore found to be discarded, mixed with general waste and disposed off at the disposal sites, except for HHW that has specific economic value for recycling or recovery such as electronic and electrical wastes (e-wastes) and lead acid batteries of vehicles.

Some efforts to properly segregate and store HHW have been made but mostly on an ad hoc basis by local authorities or non governmental organisations (NGOs). To some extent, these campaigns have created awareness among the public on HHW. However, an overall plan and framework towards proper management of HHW at nationwide level is not available. The public cannot afford at the moment to pay for each can of insecticide that they have used, to be disposed off at the Kualiti Alam scheduled waste treatment facility in Negeri Sembilan. It is therefore not uncommon to hear that some campaigns even face difficulty in disposing off the HHW collected from the public.

Although the Environmental Quality Act (1974) has been in place for several decades in Malaysia, the enforcement of the Act at the household level in relation to HHW has yet to be mandatory because of the complicated issues of demarcation of powers between the Department of Environment (DOE) which regulates hazardous

E-waste.

or scheduled wastes in the country, and the Ministry of Housing and Local Government (MHLG) which wields the power on general solid waste management at the household level.

Under the new set up of solid waste management tailored under the Solid Waste and Public Cleansing Management Act (2007), the National Solid Waste Management Department (JPSPN) and the Solid Waste Management and Public Cleansing Management Corporation (PPSPPA) will have the operational arms to reach out to waste collection down to household level. It is therefore crucial for these authorities to have clear demarcation or delineation of powers with DOE so as to come up with a long term solution for HHW management issues.

## Conclusion

Proper handling and management of HHW is important and therefore should be part of the overall waste management plan of a country in order to achieve absolute sustainable development. The proper handling of HHW will ensure the following benefits in the long run:

- Reduction and recycling of HHW conserves resources and energy that would be expended in the production of more products.
- Reuse of hazardous household products can save money and reduce the need for generating hazardous substances.
- Proper disposal of HHW prevents pollution that could endanger human health and the environment.

Although there is still no clear direction at the moment on HHW management in Malaysia, an individual should practise the concept of 3R to reduce, reuse and recycle HHW to the greatest extent possible. The reduction in HHW generation will at least reduce the burden of pollution loads on the environment, and subsequently reduce overall detrimental impacts on the ecosystem and human health as a whole.

**"Individuals Can Make a Difference!"**

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# Sustainable Ecotourism

World's longest tree-based canopy walk.

Boat ride via Rompin.

The world's oldest tropical rainforest is in Malaysia for all to explore and enjoy, a haven for hundreds of species of wildlife, exotic birds and plants. Malaysia has plenty of natural attractions to satisfy even the most discerning of adventure seekers. Adventure ranging from challenging jungle treks to leisurely swims in natural pools and waterfalls to the adrenaline-pumping thrills of climbing mountains to a sedate walk in the jungles and cave exploration are among the ecotourism activities that beckon a tourist. Warm weather, natural beauty spots and conservation efforts by the government have all combined to make Malaysia an ideal destination for ecotourism. The question is: how well are we managing our ecotourism sites in terms of responsible conservation practices as well as long-term benefits to the resource, industry and the local community?

Ecotourism is being increasingly confronted with arguments about its sustainability and compatibility with environmental protection and community development. What actually constitutes sustainable ecotourism? As the title suggests, two essential components constitute 'sustainable ecotourism'.

## Ecotourism Defined

As defined by the *guru* of ecotourism, Ceballos Lascurain, ecotourism can be defined as "ecologically sustainable tourism with a primary focus on experiencing natural areas that foster environmental and cultural understanding application and conservation." It has also been defined as environmentally responsible travel and visitation to relatively undisturbed natural areas in order to enjoy and appreciate nature (and any accompanying cultural features) that promotes conservation, has low negative visitor impact and provides for beneficially active socio-economic involvement of local populations.

## Sustainability Defined

We next come to defining the concept of sustainability so as to come to grip with sustainable ecotourism. Sustainable ecotourism involves a challenge to develop quality tourism without adversely affecting the natural and cultural environment that maintains and nurtures them. At the heart of sustainable tourism is a set of implicit values related to integration of economic, social and cultural goals.

The approaches to sustainability may be categorised into three: (i) principle-based, (ii) managerial, and (iii) scientific. Principle based approaches in sustainable ecotourism require all activities, regardless of their scale, to respect the principles and to follow guidelines or codes of conduct where they exist. While principles are the foundational statements of belief about what ecotourism should be, guidelines indicate expectations about behaviour and codes of conduct set out and specific actions that should be taken to comply with the principles. Meanwhile managerial initiatives comprise those that focus upon standards of practice, which, if followed, will assure achievement of sustainable tourism goals. The focal point of all managerial initiatives is the individual organisation which is expected to manage its environmental impact throughout all of its activities. The scientific approach would include new innovations and technology-driven approaches in encouraging sustainable management.

As can be seen, ecotourism is not a product. Its underlying base is a philosophy that relies on a common understanding by the various stakeholders of the feasibility, opportunity and problems of the tourism industry. Essentially, ecotourism should be based on five basic tenets.

## Tenets of Sustainable Ecotourism

### 1 *Monitoring Visitation Level and Carrying Capacity*

Tools for monitoring visitation stress levels at prime sites need to be in place according to the concept of carrying capacity. This can only be done at the local or regional level. The carrying capacity of an area or site has three dimensions.

(a) Quality of visitor experience
This level of carrying capacity embodies the relation between the tourists themselves and has strong implications on their willingness to pay.

(b) Social carrying capacity
This is the interplay between the host population and visitors. This is a subjective consideration from the community as a whole. Experience has shown that if locals are integrated positively and voluntarily in tourism service provision, the willingness to receive tourists increases. That is why it is beneficial for the travel and tourism industry to buy local goods and services as far as possible.

(c) Ecological carrying capacity
This is the relation between the tourists and the environment itself. This is a non negotiable dimension of the concept of carrying capacity that can be determined by researchers. The monitoring of visitation levels need to be coordinated by the local system of authorities, landowners, businesses, non governmental organisations (NGOs) etc. A taskforce may be needed to undertake this work.

### 2 *Benefiting the Local People*

The second common denominator is that local people should neither be excluded from the opportunity to benefit from tourism, nor should tourism development be imposed on them. Local people are persons living in or in the immediate surroundings of the tourist areas. There are two approaches to engage local people in the tourism industry:

(a) 'Hire the local people' approach which recommends tour operators to hire the services of local people and buying their products and services as far as possible.

(b) 'Empowerment approach' which advocates that local people should be given the opportunity to be engaged commercially and directly in the operations.

Appropriate support structures need to be built so that local people living in areas of tourism interest can easily access information on how tourism operates and as a consequence decide to invest their time and money on a part time or full time basis to offer tourism services.

**3 *Cross-sectoral Interplay***

The third common denominator is the collaboration between various interest groups at the local and national level for sound use of open access resources such as cultural and natural landscapes as well as protected areas. There is an urgent need to have a common understanding of the problems and opportunities of tourism dynamics between the government and private sector as well as the various NGOs before sensitive areas are promoted as commercialised tourist sites.

**4 *Appropriate Pricing Strategies***

According to Agenda 21, the environmental costs of a tourist site should be built into the prices of goods and services. However, such mechanisms do not exist in our country. Gross pricing policy needs to be established to facilitate a more fluid collaboration between local companies, distributors and all market players.

**5 *Responsible Marketing***

Well motivated visitors who arrive in a host destination with the appropriate expectations on travel experiences that can actually be delivered is a very important issue and a prime concern for sustainability. It is required to work jointly so as to better harmonise the expectations of tourists to what actually can be delivered.

All these five systematic level issues need to be dealt with simultaneously at the local or regional level. The work will mature over time and will develop differently and at a different pace depending on the host area. This development must be allowed to be site-specific. It is best that a taskforce be formed locally to address these issues and to monitor them over time.

## Training for Sustainable Tourism

If ecotourism is meant to make the world a better place for the present and future generations, there needs to be a focus on conservation training for all levels of employees. Managers, staff as well as contract employees need to be exposed to programmes that will upgrade their ability to communicate with and manage clients in sensitive natural and cultural settings. Some measures that need to be taken are as follows:

1. Establish clear guidelines for staff regarding opportunities and company support available for training via internal training programmes (natural and cultural setting) and via training programmes available locally (language skills and first aid, accounting, mechanics etc.).
2. Establish an operators consortium for training.
3. Establish relations with a local educational facility and work to integrate needed training components into the curriculum.
4. Work with non governmental organisations to establish an ecotourism training programme.

Concerted training efforts by both the operators and the government should help create a large pool of local people with the requisite information to be employed in increasingly responsible positions that extend beyond the service employment sector. This should go a long way to make ecotourism beneficial to the local communities.

## Benchmarking Tools

An ecotourism certification programme based on internationally-accepted certification standards would certainly help mitigate negative environmental and social impacts of the growing mass ecotourism industry which is increasingly affecting developing countries. As the tourism industry in Malaysia becomes more aware of the huge economic benefits of ecotourism, certification via a creditable, voluntary independent third party mechanism is vital. Capturing this new, lucrative market presents a window of opportunity for local communities to secure the long-term financial viability of these ecotourism operations.

Two examples of certification-like tools that can create awareness and assist ecotourism operators to move towards sustainability and being responsible is Universiti Putra Malaysia's Expert Rating System (Nair *et al.* 2003) that was developed to monitor and rate the ecotourism destinations in Peninsular Malaysia and Wild Asia's Responsible Tourism checklist criteria. In both these tools, explicit and tacit knowledge is utilised to evaluate the eco-destination objectively. This knowledge-based tool can benefit the ecotourism industry by assisting operators to plan, guide and develop eco-sites in a monitored and controlled manner for effective and efficient management. Use of certification tools should enable the large number of eco-sites in Malaysia to be effectively checked and managed, with good enforcement and scrutiny.

Swirling formations of millions of bats take to the skies every evening.

Lincoln's Silhouette clearly visible at the Deer Cave.

## Conclusion

In a market driven environment, what the ecotourism industry needs and the public must demand is a ruler for measuring the impact of tourism on natural resources. The sustainability debate involves how to pursue the goal and how to measure progress towards the goal. Ensuring that nature based tourism establishes and maintains high standards will be a challenge for all parties. The management of a sensitive ecosystem in the ecotourism context can in a way protect a country's heritage and make it available for local education and tourism. The investment in such facilities is usually repaid through tourists who come in throngs and stay longer because there are more things to see and do and at the same time be contended that the sustainability of the site is being looked into. The environment is the resource base for tourism; without protection, the natural attraction that brought the tourist in the first place will be lost.

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**Some of the information contained in this article has been previously used in articles prepared for Business Today.*


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# Human Impact on the Coastal and Marine Environment

## Historical Perspective

In the past, environmental issues in relation to population were basically framed in terms of the natural resources required to sustain the population growth and economic development. Later during the 1960s, there was increased awareness that global population growth was reaching an unprecedentedly high level. For example, there was a report by the Secretary-General of the United Nations entitled "Problems of the human environment" citing "explosive growth of human populations" as first among the portents of a crisis from a worldwide scope concerning the relationship between man and his environment.

This report then led to the convening of the Conference on the Human Environment in Stockholm (1972) by the United Nations. Following that, the United Nations Conference on Environment and Development was held in Rio de Janeiro, Brazil (1992) marking the evolution of an international consensus on the relationships among population, development and environment, based on the concept of sustainable development articulated a few years earlier by the World Commission on Environment and Development. The Commission had defined sustainable development as "that meets the needs of the present without compromising the ability of future generations to meet their own needs". Table 1 briefly illustrates the development of the relationship between population increase and the environment over the years.

Table 1: Evolution of environmental concerns from the 1940s to the present time.

| Timeframe | General Concern | Specific Issues |
|---|---|---|
| 1940s – 1950s | Limited natural resources | • Inadequate food production<br>• Depletion of non-renewable resources |
| 1960s – 1970s | By-products of production and consumption | • Air and water pollution<br>• Waste disposal<br>• Chemical contamination |
| 1980s – 1990s | Global environmental change | • Climate change<br>• Acid rain<br>• Ozone depletion |
| 1990s - present | Global environmental change | • Biodiversity<br>• Deforestation<br>• Water management<br>• Globalization |

*Source:* Adapted from V.W. Ruttan(1993). Population growth, environmental change and innovation: implications for sustainable growth in agriculture. In *Population and Land Use in Developing Countries*, ed. C.L. Jolly and B.B. Torrey. Washington, DC: National Academy Press.

## Situation In Malaysia

According to the Food and Agriculture Organization of the United Nations (FAO), environmental problems are mainly related to the impacts of human activities on the natural resources. This generally takes the form of pollution, depletion or degradation of the environment. In general, the overall population growth places increasing pressure and demand for resources to support daily livelihood, besides generating socio-economic development. As for Malaysia, the 2000 population census gave a population of 23.3 million, showing an annual growth rate of 2.6 % per annum for the period of 1991-2000.

Being a nation surrounded by seas, the coastal zone and marine resources play a major role in settlement and employment patterns, as well as for the national economy. Some of the important activities in the coastal zone include fisheries, aquaculture, sea transport, tourism and recreation. Accordingly, about 98% of the population in Malaysia lives within 100 km of the coasts.[1] However, it has been increasingly recognised that human activities pose significant threats to the sea in one way or another. Some of these major environmental concerns include threats from land-based and marine pollution, over-exploitation of living marine resources and irresponsible activities leading to habitat degradation. Such impacts are worsening over time while new issues such as climate change and food security concerns have emerged lately.

For instance, one of the first global assessments of coral reefs revealed that almost 60% of the earth's coral reefs are threatened by human activities, ranging from coastal development and overfishing to inland and marine pollution, leaving much of the world's marine biodiversity at risk. Accordingly, coral reefs of South-east Asia were discovered to be the most threatened of any region. More than 80% were recorded as vulnerable, primarily from coastal development and fishing-related pressures.

## Pollution

The United Nations Environment Programme (UNEP) (1990) had estimated that 80% of marine pollution comes from land-based sources globally.[2] In Malaysia, this includes both point and non point sources of pollution. The major point sources of water pollution are sewage disposal as well as sewerage works, agro-based industries, manufacturing industries, sullage or grey water from commercial and human settlements, and pig farms. On the other hand, the non point sources include pollution that comes from many diffuse sources and is associated with rainfall moving over and through the ground. There are at least three types of runoff pollution which include agricultural runoff, forestry runoff and urban runoff. The more significant water pollution sources in Malaysia include that from sewage treatment plants, manufacturing industries, ani-mal farms, and agro-based industries. Besides, coastal and marine eutrophication from elevated nutrient inputs, sedimentation flow into coastal areas from development activities, as well as heavy metal pollution have emerged as a worrying trend as well. Figure 1 shows the trend of coastal marine water quality status based on a comparison of total suspended solid (TSS), oil and grease (O&G), and *Escherichia coli* (which is an indicator of faecal contamination in the water) while Figure 2 illustrates heavy metal contamination in Malaysian coastal areas over a 10-year period (next page).

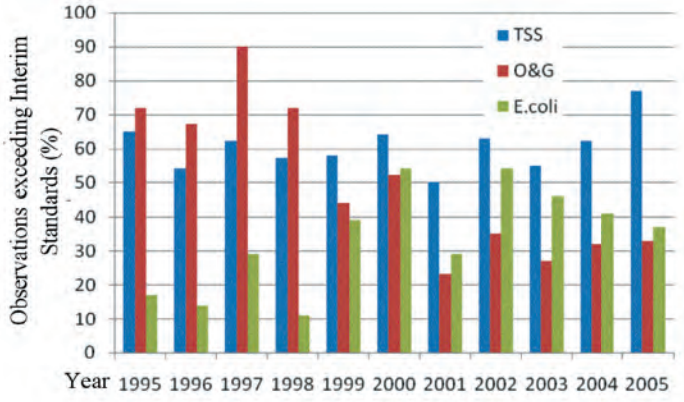


Figure 1: Coastal area water quality status over a 10-year period (1995 -2005).
*Source:* Data from the Department of Environment Malaysia

## Over-exploitation of Marine Fisheries Resources

Globally, despite the immense improvement in quality and scope of fisheries information, better fisheries management has generally not been up to the mark in many states. There has been an almost inexorable global trend towards increasingly intense exploitation and depletion of fisheries stocks.

The issue of overexploitation of fisheries resources is not new in Malaysia also. It has increasingly become a threat, creating issues of employment, income, as well as food security concerns for the country. Figure 3 (p.13) shows the landings of marine fisheries in the country from the years 1990 to 2006. Although the graph shows the landings to be somewhat stagnant or increasing, however the catch-per-unit of fishing effort (CPUE) has been generally decreasing over the years (Table 2, p.13). In addition, the amount of trash fish caught from the overall catch also indicates an increasing trend. For example, 284,260 tonnes of trash fish were caught in year 1997 (of the total marine fish landings of 1,168,973 tonnes) compared to 357,083 tonnes caught in year 2006 (of the total marine fish landings of 1,379,773 tonnes). This illustrates that

Table 2: Trawl data on fisheries resource in Malaysian waters.

| Research | Data | Source |
|---|---|---|
| Demersal fisheries in Malaysian waters | CPUE decreased from 131.1 kg/hr (in year 1970) to 55 kg/hr (in year 1981). | Saharuddin (1995) |
| Demersal and pelagic fish survey in Malaysian EEZ / offshore fishery resources | A catch rate of 43.41 kg/hr recorded for demersal fish, 6.38 kg/hr for pelagic fish and trash fish contributed 7.10 kg/hr. These figures showed a 5.7% decline from the survey conducted by the Department of Fisheries Malaysia (DoFM) during the years 1985-1987. | Department of Fisheries Malaysia (1997) |

the expansion in yields has been delivered by fishing on progressively smaller fishes at lower levels in the marine food web as most of the top predators have been depleted. This is also parallel to the increase in number of fishermen working on licensed vessels in the country, from 78,989 in year 1997 to 97,947 in year 2006.

## Physical Impact

Direct physical alteration and destruction of habitats is now viewed as arguably one of the most important threats to coastal environments. Basically, the driving force for physical alteration is ill-planned, accelerating social and economic development in coastal areas, which itself results from increased pressure from population, urbanisation and industrialisation, as well as tourism. For example in many areas, mangrove and seagrass ecosystems are being destroyed to give way to developmental projects.

## Climate Change

The most recent emerging concern to the coastal and marine environments is from the phenomenon of climate change. The Intergovernmental Panel on Climate Change (IPCC) has projected that this indirectly human-induced phenomenon in the atmosphere worldwide would have dramatic effects on the ocean, threatening valuable coastal ecosystems and the economic sectors that depend upon them. One particular concern about the possible effects of global warming is on coral reefs. For example, during the El Niño of 1997-98, extensive coral bleaching occurred on coral reefs worldwide. While some reefs quickly recovered, others, particularly in the Indian Ocean, South-east Asia and the far western Pacific, suffered significant mortality, more than 90% in some cases. Furthermore, the IPCC is expecting the frequency of coral bleaching incidents to increase within the next 20 to 30 years. Malaysia's reefs in particular are also not spared from this threat. For example, scientists from the local universities discovered recent evidence of bleaching among Tioman's reefs last year.

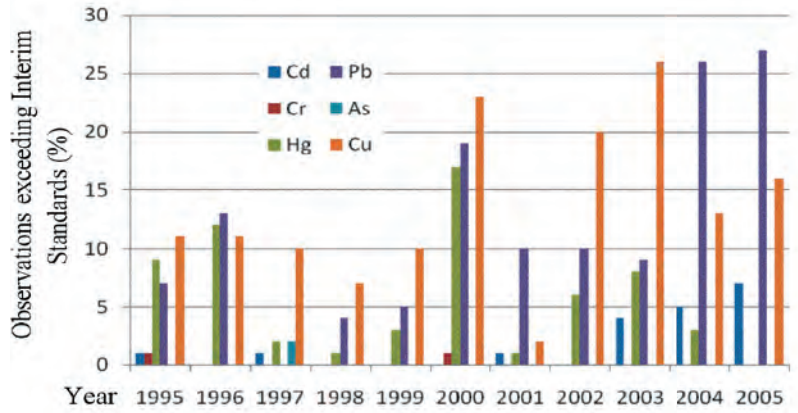


Figure 2: Heavy metal contamination in the coastal areas over a 10-year period (1995-2005).
*Source:* Data from the Department of Environment Malaysia.

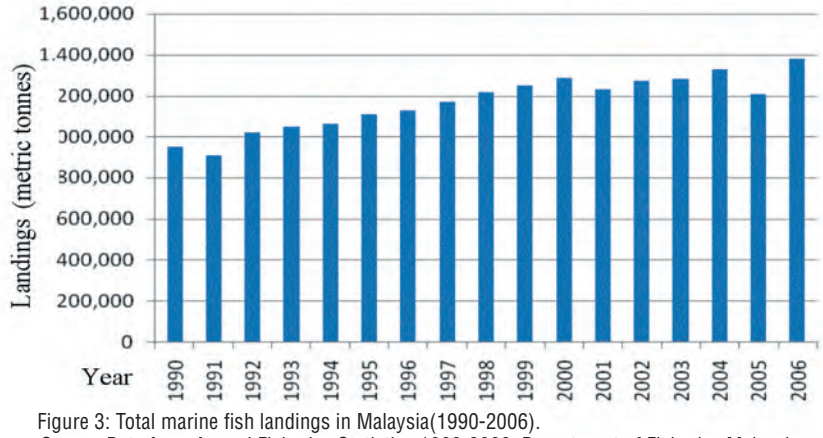


Figure 3: Total marine fish landings in Malaysia(1990-2006).
*Source:* Data from Annual Fisheries Statistics 1990-2006, Department of Fisheries Malaysia.

## Conclusion

Looking at all the issues currently being faced due to human activities associated with coastal and marine environments, it is crucial to take a holistic approach to environmental issues. The linkages between population dynamics and the environment could be probably best addressed by local environmental management initiatives through the implementation of specific operational plans. For example, Agenda 21 for Malaysia needs to be better utilised to forge partnerships between local authorities, communities and business to discuss, to seek consensus, to plan and to act on sustainable development issues which affect the livelihood of the people. Some of the other approaches to managing marine and coastal environments from the impact of human activities that have been widely recognised and formalised in many parts of the world include the Integrated Coastal Zone Management (ICZM) Plan, the establishment of marine protected areas (MPAs), the introduction of a Code of Conduct for sustainable exploitation of the fisheries resources, and the enforcement of laws and regulations on pollution related matters.

## Footnotes

1 Partnership in Environmental Management for the Seas of East Asia (PEMSEA). 2003. Sustainable Development Strategy for the Seas of East Asia: Regional Implementation of the World Summit on Sustainable Development Requirements for the Coasts and Oceans. PEMSEA, Quezon City, Philippines.

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3 CPUE can be defined as the total catch divided by the total amount of effort used to harvest the catch. Available online at http://stats.oecd.org/glossary/detail.asp?ID=295

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# Arsenic in Drinking Water: Toxicity, Health Hazards and Treatment Methods

Arsenic is a heavy metal whose Greek word arsenikon means potent. Arsenic cannot be easily destroyed and can only be converted into different forms or transformed into insoluble compounds in combination with other elements, such as iron. Many impurities such as lead, iron and selenium may be mixed up with arsenic wastes, making removal uneconomic.

The presence of arsenic in natural water is related to the process of leaching from arsenic containing source rocks and sediments (Robertson,1989; Hering & Elimelech,1995). Though most of the environmental arsenic problems are a result of mobilisation under natural conditions, man has had an important impact through mining activity, combustion of fossil fuels, the use of arsenical pesticides, herbicides and crop desiccants and the use of arsenic as an additive to livestock feed, particularly for poultry. Although the use of arsenical products such as pesticides and herbicides has decreased significantly in the last few decades, their use for wood preservation is still common. The impact on the environment of the use of arsenical compounds, at least locally, will remain for some years.

Of the various sources of arsenic in the environment, drinking water probably poses the greatest threat to human health. Drinking water is derived from a variety of sources depending on local availability: surface water (rivers, lakes, reservoirs and ponds), groundwater (aquifers) and rain water. These sources are very variable in terms of arsenic risk. Alongside obvious point sources of arsenic contamination, high concentrations are mainly found in groundwaters.

## Toxicity and Reported Health Hazards

Arsenic contamination in natural water is a world wide problem and has become an important issue and challenge for the world's engineers, scientists and even the policy makers. For example, chronic arsenic toxicity due to drinking arsenic-contaminated water has been one of the worst environmental health hazards affecting eight districts of West Bengal since the early eighties. Detailed clinical examination and investigation of 248 such patients revealed protean clinical manifestations of such toxicity. Over and above hyperpigmentation and keratosis, weakness, anaemia, burning sensation of eyes, solid swelling of legs, liver fibrosis, chronic lung disease, gangrene of toes, neuropathy, and skin cancer are some of the other manifestations (Guha Mazumder, 2003).

The World Health Organization (WHO) revised the guideline for arsenic from 0.05 to 0.01 mg/l in 1993 (WHO, 1993). Table 1 shows the national standards on arsenic in drinking water for various countries.

The toxicology of arsenic is a complex phenomenon and generally classified into acute and sub-acute types (Jain & Ali, 2000). Acute arsenic poisoning which requires prompt medical attention usually occurs through ingestion of contaminated food or drink. Early manifestation includes burning and dryness of the mouth and throat, dysphasia, colicky abnormal pain, projectile vomiting, profuse diarrhoea, and hematuria. Muscular cramps, facial edema and cardiac abnormalities can develop rapidly as a result of dehydration (Done & Peart, 1971). In general, there are 4 recognised stages of chronic arsenic poisoning (National Academy of Science, 1977) :

- Pre-clinical: The patient shows no symptom, but arsenic can be detected in urine or body tissue samples.
- Clinical: Various effects can be seen on the skin at this stage. Darkening of the skin (melanosis) is the most common symptom, often observed on the palms. Dark spots on the chest, back, limbs or gums have also been reported. Oedema (swelling of hands and feet) is often seen. A more serious symptom is keratosis, or hardening of skin into nodules, often on palms and soles. WHO estimates that this stage requires 5-10 years of exposure to arsenic.
- Complications: Clinical symptoms become more pronounced and internal organs are affected. Enlargement of liver, kidneys and spleen has been reported. Some research indicates that conjunctivitis, bronchitis and diabetes may be linked to arsenic exposure at this stage.
- Malignancy: Tumors or cancers (carcinoma) affect skin or other organs. The affected person may develop gangrene or skin, lung or bladder cancer.

Table 1: Currently accepted national standards for arsenic in drinking water.

| Standard | Countries (year implemented) |
|---|---|
| Countries whose standard is lower than 0.01 mg/l | Australia (0.007 mg/l, 1996) |
| Countries whose standard is 0.01 mg/l | Jordan (1991), Laos (1999), Laos, European Union (1998), Japan (1993), Mongolia (1998), Namibia, Syria (1994) |
| Countries whose standard is lower than 0.05 mg/l but higher than 0.01 mg/l | Canada (1999) 0.025 mg/l |
| Countries considering to lower the standard from 0.05 mg/l | United States (1986), Mexico(1994) |
| Countries whose standard is 0.05 mg/l | Bahrain, Bangladesh (unknown), Bolivia (1997), China (unknown), Egypt(1995), India (unknown), Indonesia (1990), Oman, Philippines (1978), Saudi Arabia, Sri Lanka (1983), Vietnam(1989), Zimbabwe |

## Treatment and Removal of Arsenic

Conventionally, there are several methods for arsenic removal. These methods include coagulation and flocculation, precipitation, adsorption and ion exchange and membrane filtration. Alternative methods like ozone oxidation, bioremediation and electrochemical treatments are also used in the removal of arsenic.

### *Coagulation and Flocculation*

In arsenic removal processes, coagulation and flocculation are among the most common methods employed:

1. Coagulation is the destabilisation of colloids by neutralising the forces that keep them apart. Cationic coagulants provide positive electric charges to reduce the negative charge causing the particles to collide and form larger particles. Rapid mixing is required to disperse the coagulant throughout the liquid.
2. Flocculation is the action of polymers to form bridges between the larger mass particles or flocs and bind the particles into large agglomerates or clumps. Bridging occurs when segments of the polymer chain adsorb on different particles and help particles aggregate.

### *Adsorption and Ion Exchangers*

Adsorption is a process that uses solids for removing substances from either gaseous or liquid solutions. Adsorption operations employing solids such as activated carbon, metal hydrides and synthetic resins are used widely in industrial applications and for purification of waters and wastewaters. The process of adsorption involves separation of a substance from one phase accompanied by its accumulation or concentration at the surface of another.

For arsenic removal an ion exchange resin, usually loaded with chloride ions at the 'exchange sites', is placed in vessels. The arsenic containing water

Table 2: Concentration of arsenic in urine, hair and nails of the affected people in different arsenic contaminated water ingestion episodes (Karim, 2000).

| Location | Concentration in urine (mg/l) | Concentration in hair (mg/kg) | Concentration in nails (mg/kg) |
|---|---|---|---|
| Fairbanks, AL | 0.1783 | 1.0 | 4.0 |
| Millard County, UT | 0.025-0.66 | 0.10-4.7 | - |
| Antofagasta, Chile | 0.025-0.77 | 4.0-83.4 | - |
| Lassen County, CA | - | 0.01-2.0 | - |
| Taiwan | 0.0366-0.259 | - | - |
| West Bengal, India | 0.03-2.0 | 1.81-31.05 | 1.47-52.03 |
| Bangladesh | 0.05-9.42 | 1.1-19.84 | 1.3-33.98 |

is passed through the vessels and the arsenic 'exchanges' for the chloride ions. The water exiting the vessel is lower in arsenic but higher in chloride than the water entering the vessel. Eventually, the resin becomes 'exhausted', that is, all or most of the 'exchange sites' that were loaded with chloride ions become loaded with arsenic or other anions. The chloride ions on the resin are exchanged for the arsenic and other anions in the water being treated. Figure 1 shows an example of an ion exchanger.

Figure 1: Typical ion exchange system composed of pressure vessels filled with anion exchange resin.

### *Membrane Filtration*

Membrane separation is a pressure driven process. Pressure driven processes are commonly divided into four overlapping categories of increasing selectivity: microfiltration (MF), ultrafiltration (UF), nanofiltration (NF) and hyperfiltration or reverse osmosis (RO). MF can be used to remove bacteria and suspended solids with pore sizes of 0.1 to micron. UF will remove colloids, viruses and certain proteins with pore size of 0.0003 to 0.1 microns. NF relies on physical rejection based on molecular size and charge. Pore sizes are in the range of 0.001 to 0.003 microns. RO has a pore size of about 0.0005 microns and can be used for desalination. High pressures are required to cause water to pass across the membrane from a concentrated to dilute solution. In general, driving pressure increases as selectivity increases.

### *Precipitation Processes*

Four precipitation processes are used: alum coagulation, iron coagulation, lime softening and a combination of iron and manganese for removal of arsenic.

### *Alum Precipitation*

For the removal of arsenic, alum is most effective if an oxidising agent, such as chlorine, is added ahead of the flocculator and clarifier and the pH is reduced to 7 or less. It would probably be necessary to use a number of chemicals in order to treat the arsenic in the drinking water. The arsenic removed from the water would be contained in the alum sludge from the tile clarifier (Kartinen & Martin, 1995).

### *Iron Precipitation*

In this process, an iron compound, such as a ferric salt (for example, ferric chloride or ferric sulphate), is added to the untreated water. The arsenic combines with the iron to form a precipitate (iron oxyhydroxide in the form of sludge) that settles out in the clarifier. Following the clarifier, a filter is employed which removes iron/arsenic particles not taken out in the clarifier. The best arsenic removal rates are obtained at a pH of less than 8.5 with or without chlorine (Kartinen & Martin,1995). In practice, ferric chloride is more frequently used than ferric sulfate.

### *Lime Softening*

Arsenic can also be removed by lime softening but this technology is justified when softened water is required. For this case, the suppliers prefer a treatment in two stages: removal of arsenic followed by lime softening (Gaid, 2005). The arsenic removal efficiencies of the lime softening process are significantly affected by the pH and the presence (or absence) of chlorine. Chlorine is required to oxidise the arsenic and acid would probably be necessary to lower the pH of the treated water to acceptable drinking water levels. The arsenic removed from the water will be removed together with the lime sludge produced by the process.

### *Oxidation with Ozone*

Ozone when added to water which contains arsenic and soluble iron, will oxidise both arsenic and iron, forming sites on the ferric hydroxide for arsenic to adsorb. The arsenic bearing iron hydroxide can then be removed by solid liquid separation processes.

### *Biological Remediation*

Biological treatment has been demonstrated to be a useful alternative to conventional treatment systems for the removal of toxic metals from dilute aqueous solution. However, the bioprocesses for treating toxic effluents must compete with existing methods in terms of efficiency and economy. It is expected that future biotechnological methods of toxic waste treatment will play a key role as a displacement for the existing methods.

## Conclusion

To remove arsenic from waste waters, the most commonly used technologies are adsorption onto activated alumina, and precipitation or adsorption by metals oxides, predominantly Fe (III) and membranes. These technologies for removal of arsenic from waste waters are most suited to dealing with relatively low concentrations of arsenic, i.e. the low µg/l level. However, the technique of precipitation, generally using Fe (III) or lime softening is suited to higher concentrations, normally at the low mg/l levels.

Adsorption has been an important method in arsenic removal. Most studies are focused on the type of adsorbent mediums and the economics of their regeneration. Membrane technology especially nanofiltration has emerged as a promising method in arsenic removal and is also widely considered as the method of use to meet regulations for lowered arsenic concentrations in drinking water.

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Source

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# Event Highlights

## Department of Environment, Malaysia

February 2009

### *Wira Alam* (Environmental Hero) Programme – Promotional Workshop


Thirty-five teachers from Kedah attended the *Wira Alam* Programme – Promotional Workshop held from 19–20 February 2009 at Pusat Kokurikulum Jabatan Pelajaran, Merbok, Kedah. As the objective of this workshop was to promote the *Wira Alam* Programme to teachers, several activities such as energy consumption, climate change, food chain, nature study, 5R project, environmental games and water quality study were conducted. It is hoped that the activities conducted in this workshop would help teachers to better facilitate their students in undertaking activities under the *Wira Alam* Programme.

March 2009

### *Sekolah Lestari* (Sustainable School)- Environmental Award 2009/2010- Promotional Workshop

In an attempt to promote the *Sekolah Lestari* – Environmental Award 2009/2010 programme to all schools in Malaysia, a Promotional Workshop was held from 11 – 12 March 2009 at the Bayview Beach Resort, Penang. It was attended by 32 officers from DOE state offices and State Education Departments throughout Malaysia. On the second day, all the participants visited the SMK (P) Methodist, Penang which won the 2007/ 2008 *Sekolah Lestari* Award in the secondary school category as a benchmarking exercise. The participants were given a briefing on the process of the *Sekolah Lestari* - Environmental Award, the evaluation criteria and document preparation required.

March 2009

### DOE Environmental Awareness Camp (KeKAS)

Organised by DOE in collaboration with the Ministry of Education, the Awareness Camp was held at the Teluk Batik Resort, Lumut, Perak from 13 – 15 March 2009. Forty trainee teachers and lecturers from the Institut Pendidikan Guru Malaysia, Kampus Ipoh and Institut Pendidikan Guru Malaysia, Kampus Tuanku Bainun, Pulau Pinang were trained as KeKAS facilitators. The module on marine environment and *Alami Alamku* guide book were used as training materials for the camp participants. Snorkeling, coastal soil analysis, a visit to the Siput Museum and beach cleanup were some of the activities carried out during the camp.




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