

PETRONAS TECHNICAL STANDARDS

HEALTH, SAFETY AND ENVIRONMENT

GUIDELINE

WASTE MANAGEMENT

PTS 60.3005

MARCH 2010



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This new PTS **60.3005 – Waste Management (March 2010, Revision 1)** has been developed to provide an updated and integrated user friendly waste management guideline.

This PTS also includes PETRONAS Lessons Learnt and PETRONAS Best Practice for the subject matter **Waste Management**.

The custodian of this PTS is: Manager - HSE MS, Standards & Regulations, GHSED.

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PREFACE

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1.0 INTRODUCTION

1.1 Objectives and Scope

This guideline provides structured guidance for PETRONAS Operating Units (OPUs) on handling, collecting, transferring, transporting, treating and disposing of waste.

All OPUs should use this guideline to develop a waste management plan for their activities and ecological sensitivity of the operating location. All measures discussed in this guideline need not necessarily be implemented in all geographical areas or types of operations. Specific requirements and standards should be determined by the agreement between the OPUs and the authorities of their host country/ local council.

The purpose of this document is to set the recommended standards for good technical practices on waste management for PETRONAS Groupwide.

1.2 Legal and Other Requirements

International, regional and host country laws and regulations should be reviewed to determine the types of wastes that must be highlighted by management practices. Management requirement should identify those waste types which regulations are not adequately defined.

1.2.1 Local and National Regulatory Requirements

Waste generator should comply with local and national regulations as required. For OPUs in Malaysia, please refer to **Appendix 1**.

1.2.2 International Requirements

1.2.2.1 Basel Convention on the Control of Transboundary Movements of Hazardous Waste and their Disposal

The international control of trans-boundary movements of hazardous wastes and their disposal is regulated under the United Nation Environment Programme (UNEP) Basel Convention on the Control of Transboundary Movements of Hazardous Waste and their Disposal dated on 22 March 1989 and implemented since May 1992. The Basel Convention generally allows transboundary movements of hazardous waste only if the state of export does not have the appropriate facilities for treating and disposing the wastes in an environmentally sound manner or if the waste is required as raw material for recycling or recovery operations in the state of import. This international treaty identifies the waste streams to be classified as 'hazardous' and sets the conditions under which these wastes are allowed to be transported between signatory countries. It requires the management of hazardous waste to be consistent with the protection of human health and the environment, wherever the place of disposal, taking into account the limited capabilities of the lesser developed countries.

Exports of hazardous wastes for disposal from the Organisation for Economic Co-operation and Development (OECD) countries to non-OECD countries have been banned since September 1995. Moreover the signatories of the Basel Convention have decided to prohibit exports of hazardous waste for recovery from OECD to non-OECD countries after 1997. The purpose of these measures is to discourage waste transport and the disposal and treatment in foreign countries. In cases where trans-boundary movement and disposal of waste is considered, it is necessary to know the legal constraints of the country from where export will take place and the

country of destination.

Under the Basel Convention, the categories of waste to be controlled and the list of hazardous characteristics are outlined in its Annex I and Annex III.

For waste category lists conforming to the Basel Convention and European Union (EU) legislation, please refer to **Appendix 2**.

1.2.2.2 Marpol 73/78

Marpol 73/78 is the International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978. ("Marpol" is short for marine pollution and 73/78 short for the years 1973 and 1978.)

Marpol 73/78 is one of the most important international marine environmental conventions. It was designed to minimize pollution of the seas, including dumping, oil and exhaust pollution. Its stated object is: to preserve the marine environment through the complete elimination of pollution by oil and other harmful substances and the minimization of accidental discharge of such substances.

Marpol contains 6 annexes, concerned with preventing different forms of marine pollution from ships as listed below. Out of which, two are applicable to Waste Management:

- Annex I – Regulations for the Prevention of Pollution by Oil
- Annex II – Regulations for the Control of Pollution by Noxious Liquid Substances carried in Bulk
- Annex III – Regulations for the Prevention of Pollution by Harmful Substances Carried by Sea in Packaged Form
- Annex IV – Regulations for the Prevention of Pollution by Sewage from Ships
- Annex IV contains a set of regulations regarding the discharge of sewage into the sea, ships' equipment and systems for the control of sewage discharge, the provision of facilities at ports and terminals for the reception of sewage, and requirements for survey and certification. It also includes a model International Sewage Pollution Prevention Certificate to be issued by national shipping administrations to ships under their jurisdiction.
- In general, the discharge of sewage into the sea will be prohibited, except when the ship has in operation an approved sewage treatment plant or is discharging comminuted and disinfected sewage using an approved system at a distance of more than three nautical miles from the nearest land; or is discharging sewage which is not comminuted or disinfected at a distance of more than 12 nautical miles from the nearest land.
- Annex V – Regulations for the Prevention of Pollution by Garbage from Ships
- MARPOL Annex V allows for the creation of special areas with more stringent regulations for the discharge of garbage. In general, the regulations prohibit the discharge of all garbage from a ship in special areas except food wastes. The discharge of food wastes must be made as far as practicable from land, but in any case not less than 12 nautical miles from the nearest land.
- Annex VI – Regulations for the Prevention of Air Pollution from Ships

2.0 DEFINITIONS

Waste: Any substance, whether or not that substance can be reduced, reused, recycled and recovered –

- a) that is surplus, unwanted, rejected, discarded, abandoned, obsolete, expired or disposed of;
- b) which the generator has no further use of;
- c) that must be treated or disposed of; or
- d) that is identified as a waste by the authority,

Exceptions are:

- i. a by-product is not considered waste except a by-product which has no value to the producer or any other parties known; and
- ii. any portion of waste, once re-used, recycled and recovered, ceases to be waste;

Waste can be categorised into hazardous and non hazardous waste.

Hazardous waste: Any gaseous, liquid or solid waste, which because of its quantity, physical, chemical or infectious characteristics can result in hazards to human health or the environment. This guideline discusses only liquid and solid waste.

3.0 PRINCIPLES OF WASTE MANAGEMENT

The general approach in waste management is based on the following principles:

- protection of the environment and human health,
- waste management best practise,
- life cycle thinking,
- 'the polluter pays' principle,
- 'the proximity' principle.

3.1 Protection of the Environment and Human Health

The waste management plan should ensure that the whole process of waste generation to waste disposal is harmless to the environment and health. Waste minimisation helps to sustain the natural resources, prevent environmental pollution and degradation and address sustainability concern.

3.2 Waste Management Best Practice

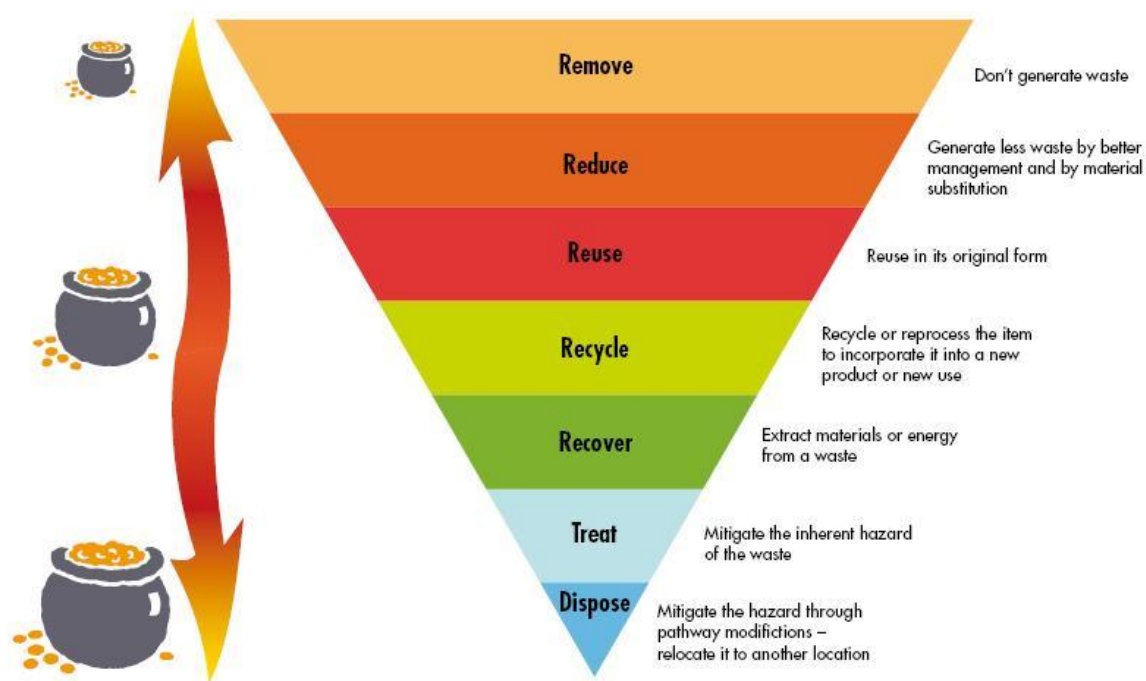


Table 1: Examples of waste management hierarchy practices are as below:-

No	Practices	Examples
1	Remove: The elimination of source of waste material	- Material elimination - Material change - Modification of process design
2	Source Reduction: The generation of less waste through more efficient practices.	- Inventory control and management - Material substitution - Process modification - Improved house-keeping
3	Reuse: The use of materials or products that are reusable in their original form.	- Reusable containers, e.g. glass, plastic, metal - Reusable packaging materials, e.g. drum, pallet - Reuse of existing equipment, e.g. storage tank and vessel
4	Recycling: The conversion of wastes into usable materials	- Recycling scrap metal - Recycling drilling mud - Recycling waste water
5	Recovery: The extraction of energy or materials from wastes.	- Recovering oil from tank bottoms and produced water - Recovering of nickel, platinum and copper from catalyst
6	Treatment: The destruction, detoxification and/or neutralisation of residue through processes.	- Biological methods, composting, tank based degradation. - Thermal methods; incineration, thermal desorption - Chemical methods, neutralisation, stabilisation, solidification, encapsulation

No	Practices	Examples
		Physical methods, filtration, centrifugation, sedimentation
7	Responsible Disposal: Deposition of wastes on land or in water using methods appropriate for a given situation.	- Land filling - Burial - Surface discharge - Land spreading and land farming - Underground injection

3.3 Life Cycle Thinking

Life Cycle Approach to Waste Management (Cradle-to-Grave)

Cradle-to-Grave is defined as a responsibility to monitor every aspect of a product or programme through its entire life cycle; from design or acquisition to disposal, or from proposal to termination. ~ Business Dictionary.com

Cradle-to-Grave is the full Life Cycle Assessment from manufacture ('cradle') to use phase and disposal phase ('grave'). The components of Cradle to Grave of the schedule waste management are:

1. Waste generator;
2. Waste contractor/ transporter; and
3. Waste treatment and disposal facilities.

3.4 The Polluter Pays Principle

This principle states that those who damage the environment must pay for the damage they have caused.

3.5 The Proximity Principle

This principle requires the disposal of waste to take place at the nearest suitable disposal centre.

4.0 WASTE MANAGEMENT APPROACH

4.1 Preparation of Waste Management Plan

Business and Operating Units should prepare a waste management plan with clear objectives.

A good waste management plan should be reviewed periodically to keep it current and relevant. The procedures and criteria for waste management should be established in compliance with the company's policy and legislative requirements, whilst minimising health, safety and environmental risks and liabilities systematically.

Management approval and support should be obtained. Key personnel or other resources and scheduling issues should be resolved so that management is aware of the timing and scope of the plan. The overall goal(s) of the waste management plan should be established with measurable objectives stated for each goal.

A waste management plan should also include emergency response procedures in case of spill or accidental discharge.

4.2 Documentation and retention of records

Business and Operating Units should implement procedures for record keeping, maintenance and control of in-house documents relating to all aspects of waste management.

Documents and essential records should be safeguarded against loss, destruction or inaccessibility. In order to be used in possible future litigation, it is essential that these records should be retained for a period of time as specified.

PETRONAS HSE Management System (HSEMS) requires records and documents to be kept for five years unless otherwise specified by the authority. The following documents and records shall be retained:

- Waste management plan
- Licenses or permits
- Procedures on waste management
- Inventory on generation and disposal of waste
Note: The requirement is only applicable for hazardous waste, but not for the non hazardous waste. It is merely a best practice.
- Reporting documents to authority
- External communication on waste

4.3 Contractors and Contractors-Related Rules

Managements of Business and Operating Units should ensure that waste is properly handled by their personnel as well as contractors. They should also comply with local and national regulations, international treaties and conventions, PETRONAS Policy and PETRONAS Technical Standard (PTS) for HSE.

Responsible companies will take independent and positive management action, similar to what responsible waste generators should take to avoid incidents which can reasonably be expected to cause harm, and to be able to provide evidence proving this. It is important to ensure that a documented audit trail covers all aspects of waste management from generation to disposal.

The transfer of waste to duly certified/ licensed and regularly audited waste transporters and disposal facilities in accordance with legislation is key to the minimisation of a waste generator's potential liability for damage allegedly caused by such waste. From a legal point of view, the waste generator holds responsibility even if the waste has been transferred or disposed of in this manner.

Contractors involved in handling, storing and disposing of waste for Business and Operating Units should have a management system consistent with the company's HSE policy and objectives. For guidance see Rules for dealing with waste contractors in Table 2 below.

Table 2: Rules for dealing with waste contractors

No	Rules
1	The contractor should practise a H, S & E management system.
2	The evaluation of a proposed waste contract should take into account: ▪ the contractor's size, financial stability and technical capability; ▪ skills of personnel and condition of equipment and facilities; ▪ availability of a HSE policy and the status of its implementation;

	▪ standard of operation and environmental performance; ▪ the contractor's valid status with authorities; ▪ status of relevant permits to handle or dispose the waste material in question
3	Provide contractor with all relevant environmental, safety, health and technical data relating to waste.
4	Require signed confirmation from the contractor that the consignment will be transferred, treated or disposed of at specified locations according to the contractual obligations and provisions of the relevant laws and regulations.
5	Ensure that emergency procedures are in place and are effective.
6	Carry out periodic audits of the contractor/ sub contractor's facilities and operations, including their waste disposal practices (If the (sub)contractors can provide regular audit reports of audits performed by certified outside (waste management system) auditors, there may not be a need for the waste generator to conduct additional audits)..
7	The waste material transferred to the contractor should be packed and labelled appropriately, and transport notification and documentation completed in accordance with regulatory requirements
8	Review the performance of the contractor periodically and keep a complete documentation.

4.4 Implementation of Area Waste Management Plan

Compile all preferred waste management and disposal options for each waste in a given operating area into one comprehensive, area-specific waste management plan.

The recommended waste management practices should be summarised in concise documents for use at the field level. Descriptions should include only the wastes generated by the operations in the specific area or within an operator's responsibility. Each waste description should indicate the chosen waste management and disposal practices.

4.5 Waste Management Audit and Review

Business and Operating Units shall carry out audits to systematically verify whether all aspects of waste management conform to the established waste management plans.

The suitability, adequacy and effectiveness of the waste management plan shall be regularly reviewed by management at an agreed interval.

The waste audit and review shall be conducted as and when required. The findings of the waste audit should be documented.

5.0 HAZARDOUS WASTE MANAGEMENT

A successful waste handling process requires several technical decisions. These focus on quantities of waste requiring disposal, giving priority to the prevention and minimisation of hazardous waste materials. The objectives of this process are to:

- Identify opportunities to prevent and minimise waste generation from operations and processes;
- Identify and eliminate hazards to human health and the environment;
- Minimise exposure to potential liabilities at an acceptable cost.

Key handling disposal decisions of the waste management process are shown in **Figure 1**, and it incorporates the concept of a waste management hierarchy which begins with source reduction and ends with disposal options.

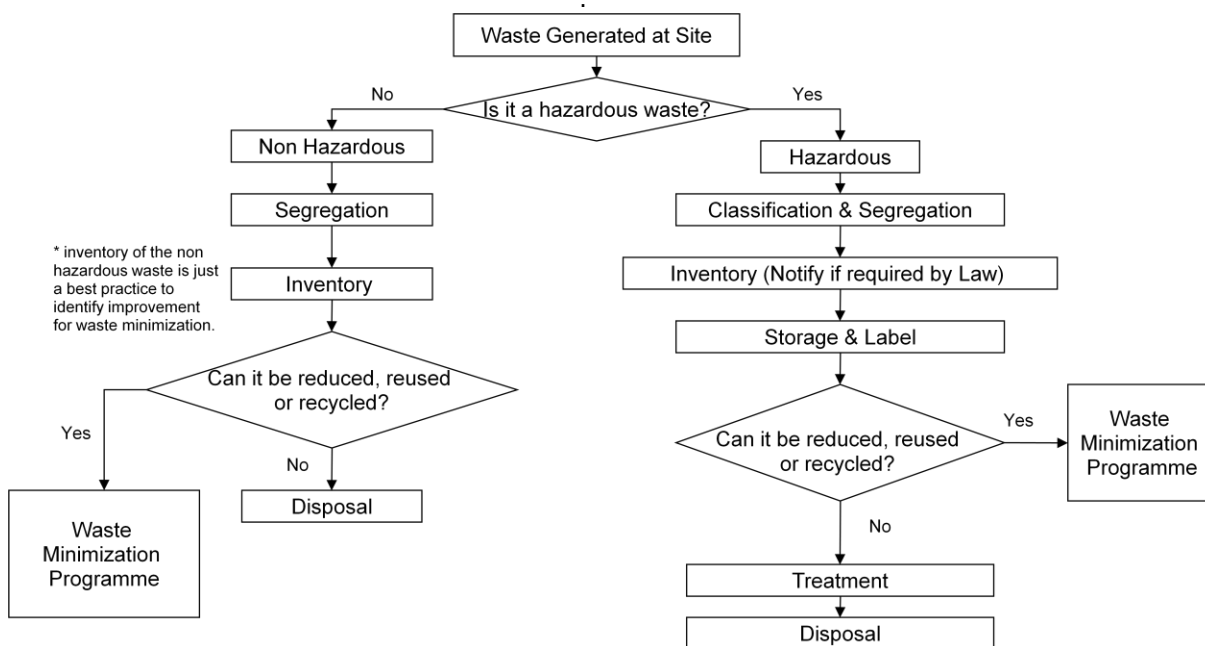


Figure 1: Key waste handling, minimisation and disposal decision in the waste management process

5.1 Characterisation of Hazardous Waste

The physical, chemical and toxicological properties of each waste should be identified. This information may be found in Material Safety Data Sheets (MSDS), manufacturer's information, process knowledge, historic information or lab analyses. A system to categorise waste streams according to their health and environmental hazards can then be developed.

Listed hazardous wastes are those that have been specifically identified and listed in the local waste regulations. The listings are based on the fact that the underlying constituents display at least one hazardous characteristic. The waste must match the listing to be classified as a listed waste. Waste that does not meet a listing exactly is still hazardous waste if it displays one of four characteristic: ignitable, corrosive, reactive or toxic.

Appendix 3 shows hazardous waste characterization as explained in Malaysia environmental regulations.

5.2 Classifications and Segregation

Waste generators shall develop and implement practical procedures and controls for identifying and segregating hazardous waste. These must comply with local legislative requirements.

- Clinical waste, radioactive waste and sewage sludge shall be identified under distinct categories of hazardous waste. Empty containers shall also merit special attention.

- Classification of other hazardous wastes shall be based on an assessment of physico-chemical, toxicological and environmental properties and characteristics.
- Hazard assessment should systematically address occupational health, community health and environmental aspects at all stages in the waste life cycle, including generating, handling, storing, transporting, treating and disposing. Chemical health risk assessment shall follow the methodology outlined in PTS 60.1502 (Chemical Management Guideline). Means of controlling the wastes handlers' exposure to the wastes chemical shall be evaluated and recommended (if necessary). Appropriate personal protective equipment (PPE), which is the last defense, shall be worn.
- Hazard assessment should be carried out with a clear focus on prevailing local circumstances to ensure that it is practical and realistic.

Different countries may have their own specific waste classification.

5.2.1 Special Categories of Hazardous Waste

Clinical waste, radioactive waste and sewage sludge should always be treated as special categories of hazardous waste. 'Empty' containers such as chemical and oil drums may also require special consideration. A brief description of these different types of hazardous waste is found below:

Table 3: Common categories of hazardous waste

No.	Hazardous waste	Description
1	Oily sludge	Oil sludge or black sludge is a solid or gel in motor oil caused by the oil gelling or solidifying, usually at temperatures lower than 100 degrees Celsius. Sludge can be a major contributor to internal combustion engine problems, and can require the engine to be replaced, if the damage is severe. Sludge is usually caused by the presence of water in the oil, and can accumulate with use. Ways to minimise sludge production and accumulation includes performing frequent oil changes and following the manufacturer's engine maintenance routine.
2	Catalyst	A substance, usually used in small amounts relative to the reactants, that modifies and increases the rate of a reaction without being consumed in the process
3	E-waste	E-waste is a popular, informal name for electronic products nearing the end of their "useful life." Computers, televisions, VCRs, stereos, copiers, and fax machines are common electronic products. Many of these products can be reused, refurbished, or recycled.
4	Organic Acids and Bases	Organic acids and bases present the familiar health and safety hazards of burns and associated tissue damage, which also influence disposal options. They are generally neutralised prior to disposal. On balance, the HSE hazards associated with acids and bases are sufficiently significant to merit overall classification as hazardous waste.
5	Chlorofluoro	Chlorofluorocarbons (CFCs) are of insignificant toxicity to

	carbons	humans. They are extremely safe in terms of mammalian and environmental toxicity. However, at the global level they are thought to contribute to the depletion of stratospheric ozone and their use and disposal are increasingly regulated at both national and international levels. CFCs should therefore be classified as hazardous waste.
6	Blasting Grit	Blasting grit may contain heavy metals, which can contaminate soil and groundwater, and free silica, which can present occupational health hazards. Used grits containing these materials should be classified as hazardous waste. Manufacturers have recently introduced grits with reduced heavy metal contents and no free silica, which do not qualify as hazardous waste. These are preferred to conventional products on HSE grounds.
7	Nickel-Cadmium and Lithium Batteries	Most OPU's use nickel-cadmium (Ni-Cd) or lithium batteries, which are classified as hazardous waste following use. Manufacturers are increasingly providing facilities for returning used batteries, which are then recycled. OPU's are encouraged to purchase materials from manufacturers and suppliers offering this option.
Special categories of hazardous waste		
1	Clinical Wastes	This category is most relevant to OPU's with their own clinics. However, medical waste can also be generated at operational locations including platforms, and must always be segregated carefully. Medical waste includes used equipment, e.g. needles, used dressings, biological samples, waste prescription drugs and all potentially pathogenic material.
2	Radioactive Wastes	These can comprise Naturally Occurring Radioactive Materials (NORM) from producing reservoirs in the form of scales or liquid effluents, radioactive sources used in well logging and tracer tests and radioactive materials from medical facilities. Radioactive waste shall be defined in terms of its specific activity, complying with local regulations, such as Atomic Energy Act 1954 and PETRONAS Group guidance.

5.3 Labeling and Packaging

The storing and labeling requirement of hazardous waste shall follow host country requirements. In the absence of such requirements, the labeling requirements stipulated in the Third Schedule of Malaysian Environmental Quality (Scheduled Wastes) Regulations 2005 shall be followed. All hazardous waste must be labeled at point of generation and not at the temporary/ transit storage area (e.g. supply base).

Appendix 4 explains the labelling requirements according to Malaysia Environmental Quality (Scheduled Waste) Regulations 2005.

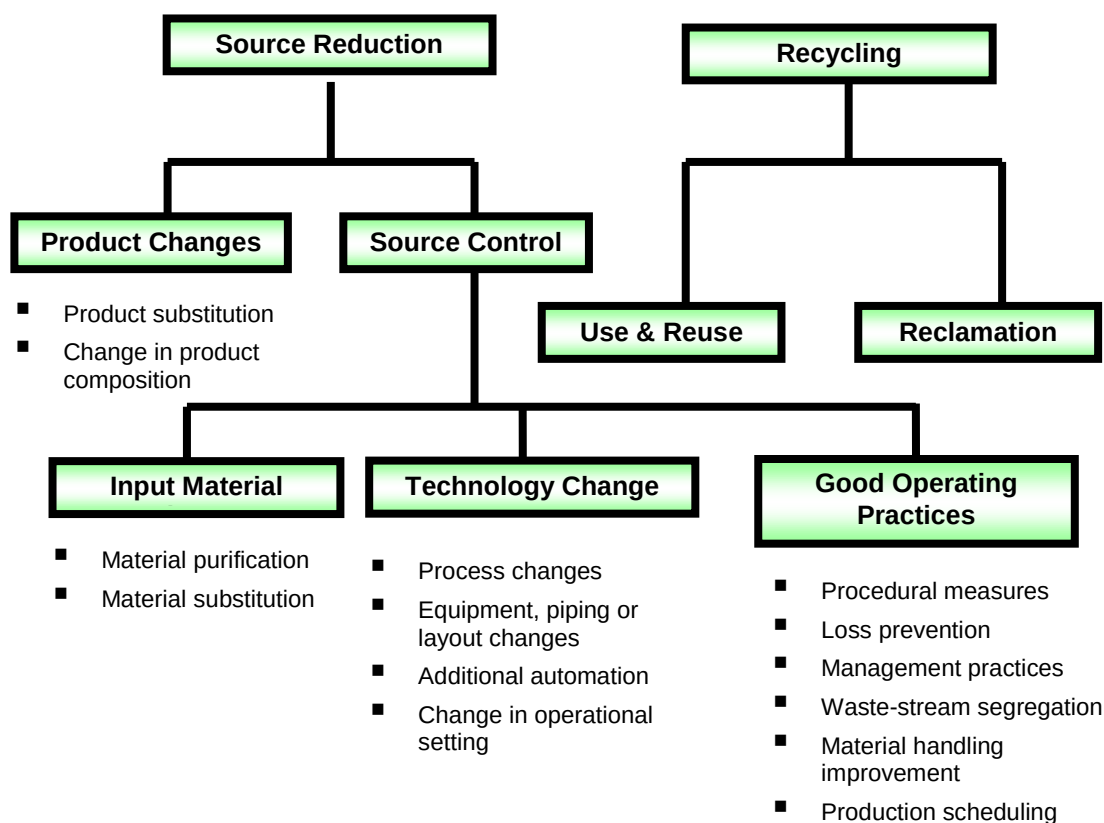
5.4 Notification and Inventory

An accurate and up-to-date inventory of hazardous waste shall be maintained by the site. It shall contain the categories and quantities of hazardous waste being generated, treated and disposed of as well as materials or products recovered from the waste. If required, relevant authorities/ parties shall be notified accordingly. An accurate and up-to-date inventory of hazardous waste shall be maintained by the site.

5.5 Waste Minimisation

Opportunities for reduction or elimination of waste, volume or toxicity, recycling and reclaiming, or treatment should be reviewed when evaluating management options. When a potential waste minimisation practice is identified, a pilot test may be desired for evaluation. Revision of the waste management plan should be made to reflect any minimisation practices implemented.

An example of waste minimization technique:



5.6 Storage

The waste owner should assess and identify a designated waste storage area within his own compound according to the waste/ hazard classification.

- The waste owner should source out appropriate containers that will not chemically react with the waste material.
- The waste should be stored in durable and compatible containers that are in good condition.
- Waste containers should be kept closed at all times unless waste is being added to or removed from the container.
- Filled and empty containers shall be segregated.
- Waste containers should be inspected regularly, or as according to host country requirements, for leaks. A proper written record of the inspection is to be kept.
- The storage duration shall adhere to host country requirements. In the absence of such requirements, the waste shall not be stored on-site for more 180 days or 20 tonnes.
- The storage area should be adequately designed.
- The classification and disposal of empty containers, particularly used chemical drums should be carried out properly.
 - The contents of containers should be known and classified adequately
 - Classification is influenced by the volumes involved
 - Rinsate from washing requires classification and may in itself be a hazardous waste.

Appendix 5 explains storing requirements according to the Malaysian Environmental Quality (Scheduled Waste) Regulations 2005.

5.7 Treatment

After source reduction, reuse, recycling and recovery opportunities have been examined, potential treatment steps to minimise waste volumes or toxicity should be considered.

Treatment methods include biological methods (e.g. land spreading, composting, tank-based reactors), thermal methods (e.g. thermal desorption and detoxification), chemical methods (e.g. precipitation, extraction, neutralisation) and physical methods (e.g. gravity separation, filtration, centrifugation).

Examples of treatment methods include biodegradation of oily wastes in a pit by tillage and addition of nutrients (fertiliser) and stabilisation of mud pit wastes by adjusting the pH to chemically stabilise and reduce the potential toxicity and mobility of inorganic compounds.

Some good practices for treatment are as follows:

- To recover oil from tank cleaning residue using appropriate method and technology.
- To contain any oil spillage and send to an oily sump system before reprocessing into the process system.
- To recover platinum from spent catalyst through expertise either in or at other countries.

Appendix 6 provides some examples of existing treatment technologies.

5.7.1 On-site/ off-site treatment

Onsite treatment is preferable due to less exposure risk on workers. The risk of incidents due to transportation is minimised. Adequate space should be allocated for onsite treatment facilities. Contractors who work for onsite treatment should provide mobile /modular equipment which are licensed by the relevant authority. It is