

# CLEANER PRODUCTION AUDIT GUIDELINES



DEPARTMENT OF ENVIRONMENT  
Ministry Of Natural Resources and Environment, Malaysia

# Cleaner Production Audit Guidelines



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## FOREWORD

**T**he Cleaner Production Audit Guidelines was produced by Department of Environment, Malaysia to give opportunity to the industries to enhance the efficiency of resource utilization, advocating waste minimization, recycling and reuse as a more cost effective option to environmental regulatory compliance.

Cleaner Production Audit is defined as a management tool comprising a systematic, documented, periodic and objective review of a company's processes, products and operations, designed to identify and provide information about opportunities to reduce environmental hazard, by reducing the use of hazardous substances in the product life cycle.

It is hoped that the Cleaner Production Audit Guidelines will contribute towards clean and healthy environment for present and future generation.

With best wishes,

Dato' Hajah Rosnani Ibarahim

Director-General of Environmental Quality  
Malaysia

## Cleaner Production Audit Guidelines

### 1.0 Introduction

CP audit is important to be conducted in order to implement the CP measures. The guidelines provided in this volume could be used to conduct the CP audit.

### 1.1 Cleaner Production Audit

The term CP Audit is a relatively new entity compared to the general concept of CP. One of the often-quoted definitions of CP Audit is as follows:

“CP audit is a management tool comprising a systematic, documented, periodic and objective review of a companies processes, products and operations, designed to identify and provide information about opportunities to reduce environmental hazard, by reducing the use of hazardous substances in the product life cycle.” (Jackson, 1991)

A more practical definition of CP Audit could be:

“The application of a systematic, documented, continuous, objective and participatory procedure consists of the following:

- to assess the function of existing or proposed production systems.
- to identify and implement relevant management actions and policy measures; and
- to accomplish integrated objectives of environmental protection and improvement, increased profitability and resources conservation”.

### 1.2 Reasons for Conducting a CP Audit

There are various reasons for conducting a CP audit in which legislative compliance is normally the prime objective in many instances. In other instances, it could be a need to reduce treatment plant cost, both capital and operating that would then demand a reduction in the quantity and strength of some priority pollutants, such as heavy metals, phenols and cyanides. In some cases, the cost and availability of resources force the industry to take a comprehensive look at the production process and identify opportunities to minimize resources consumption and waste generation.

A CP audit, therefore, is a very important part of an on-going programme designed to achieve a maximum resource optimisation and process performance. A good CP audit comprises the following aspects:

- Defines sources, quantities and types of waste generated.
- Collates information on unit operations, raw materials, products, water and energy usage and waste generated.
- Highlights process inefficiencies and areas of poor management.
- Helps set targets for CP and prioritize CP measures.
- Permits the development of cost-effective waste management strategies.
- Raises awareness in the work-force regarding the benefits of CP.

Carrying out a CP audit enables the management to take a comprehensive look at the site or process to facilitate an understanding of material flows and to focus its attention on areas where CP, and therefore cost saving, is possible.

## **2.0 CP Audit Methodology**

### **2.1 Objectives and Scope of CP Audit**

Before ever planning a CP Audit it is very important to identify the prime objective of the proposed audit, and importantly the priority problems of the concerned industrial unit. Typically, the broad objectives for a CP audit exercise could be as follows:

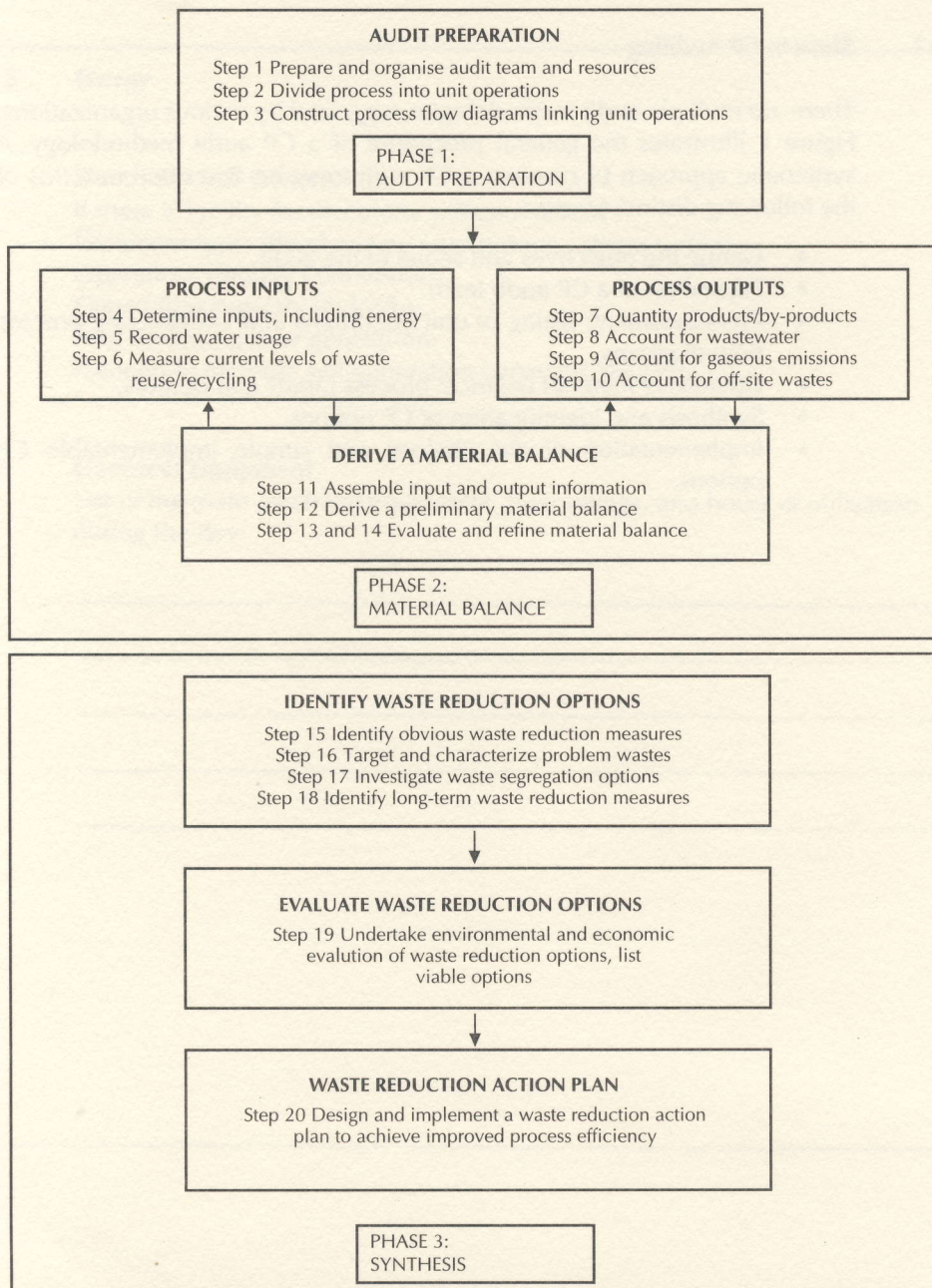
- Legislative compliance, usually for effluent compliance such as the Standard A of the Environmental Quality (Sewage And Industrial Effluents) Regulations 1979 for discharge to a watercourse, above a raw water intake.
- Reduction in waste management costs.
- Reduction in resource and energy consumption.
- Improving public relations.
- Management information.

The CP program for minimising wastes and emissions is not intended to be a one-time activity. Hence, the broad objectives set by industry may not be fulfilled in one year, but perhaps for the next five or ten years. Once the specific goals are set for the particular audit program, the schedule should be set such that the long-term objective can be achieved through these short terms goals in a step-by-step manner.

## **2.2 Steps in CP Auditing**

There are multiple audit methodologies suggested by various organizations. Figure 1 illustrates the general procedure of a CP audit methodology. A systematic approach to conduct a CP audit may be described in terms of the following distinct phases:

- Define the objectives and scope of the audit.
- Formation of a CP audit team.
- Pre-assessment: listing of unit operations and constructing process flow diagrams.
- Exhaustive material balance: process inputs and outputs.
- Synthesis and identification of CP options.
- Implementation of the obvious and simple implementable CP options.



**Figure 1:** CP audit methodology as recommended by United Nations Environment Programme and United Nations Industrial Development Organisation (1991)

### 3.0 Sample of CP Audit Questionnaire

#### 3.1 CP and Questionnaire

#### Company Background Information

Name of company: \_\_\_\_\_

Company ID: \_\_\_\_\_ Parent company: \_\_\_\_\_

No. of local subsidiaries: \_\_\_\_\_

Full postal address: \_\_\_\_\_

\_\_\_\_\_

Tel: \_\_\_\_\_ Fax: \_\_\_\_\_

Website: \_\_\_\_\_

Contact person: \_\_\_\_\_

Position: \_\_\_\_\_

E-mail: \_\_\_\_\_ Tel: \_\_\_\_\_ Fax: \_\_\_\_\_

Parent Company: \_\_\_\_\_

Major Share Holders: \_\_\_\_\_

\_\_\_\_\_

Industrial sub-sector (MIDA Classification): \_\_\_\_\_

Nature of business: \_\_\_\_\_

Main products: \_\_\_\_\_

Capacity: \_\_\_\_\_

Date commissioned: \_\_\_\_\_

Number of employees: \_\_\_\_\_

Hours of operation Per Day: \_\_\_\_\_

Per Year: \_\_\_\_\_

Type of energy used: (e.g. electricity, fuel oil, diesel, kerosene, LPG, natural gas, coal etc.)

\_\_\_\_\_

Other Information : \_\_\_\_\_

### 3.2 Production and Consumption Data

Annual Data	Unit	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
<b>Total Output</b>	Million RM							
<b>Main Product</b>	Tonnes							
<b>Raw Material Consumption</b>	Million RM							
1.	Tonnes							
2.	Tonnes							
3.	Tonnes							
<b>Utility Consumption</b>								
• Electricity	10 <sup>3</sup> kWh							
• Fuel Oil	10 <sup>3</sup> liters							
• Diesel	10 <sup>3</sup> liters							
• Kerosene	10 <sup>3</sup> liters							
• LPG	10 <sup>3</sup> liters							
• Natural Gas	m <sup>3</sup>							
• Water	m <sup>3</sup>							
• Other (specify)								
<b>Utility Bills</b>								
Electricity	RM							
Non Electricity	RM							
Water	RM							

Please provide electricity, fuel and water bills for the last 3 months

### 3.3 Plant Process Flow Diagram

- i) Process Flow Diagrams and the information to be provided:  
Process flow diagram (PFD)/simplified flowchart of the plant's main processes showing input(s) and output(s) from each stage, for instance as shown Figure 2.
  
- ii) List of different process and manufacturing stages, including equipment for producing utilities (e.g. boiler, power generation, compressed air unit, etc.)

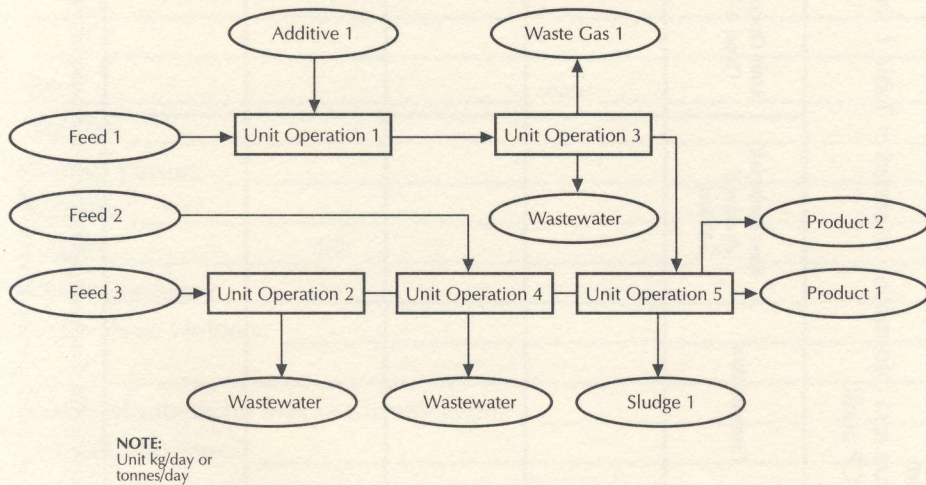


Figure 2 : Example of process flow diagram

### 3.4 Material Balance Information

For each stream in Figure 1, the data and information as stated in Table 1 should be provided:

Table 1: Process stream data from CP audit

Stream ID	Flow rate (m <sup>3</sup> / day)	Composition	Raw material/ Product/ Waste	Unit Operation (Type & ID)	Conditions (Pressure and Temperature)	Note*

*\*If it is waste stream please state the disposal method, annual quantity, cost and cause of that emission (process and sources).*

*\* If it is a product stream, kindly inform the annual quantity and sales (RM).*

### 3.5 Waste Management

Person responsible for waste management (if any):

Name: \_\_\_\_\_

Position: \_\_\_\_\_

Qualification (s): \_\_\_\_\_

Person responsible for plant maintenance: \_\_\_\_\_

Waste management structure of the plant: \_\_\_\_\_

“Progress Report” on the waste management: Yes / No

Waste Management Committee for the plant: Yes / No

Responsibility of the committee:

Formal waste management program in the plant: Yes / No

Waste program objectives: Yes / No

#### Waste Management Problems And Activities

Major waste problems as viewed by the plant management:

Indicate area where there are potentials for waste reduction:

a) The plant’s ability to implement recommendations for waste reduction.

i) \_\_\_\_\_

ii) \_\_\_\_\_

iii) \_\_\_\_\_

b) The decision-making criteria for capital expenditures for waste reduction projects.

i) \_\_\_\_\_

ii) \_\_\_\_\_

iii) \_\_\_\_\_

c) Feasibility studies have been conducted for major capital investments

Yes/No

**3.6 Energy**

**a) Electricity Self Generation**

If there is facility for electricity self-generation,  
Generator type: diesel engine / gas turbine / steam turbine  
Operation: standby / continuous  
Generation capacity (in kWh):  
Fuel used for power generation:  
Planned to increase self-generation capacity? Yes / No

**b) Electrical Equipment**

List of the main electrical equipment, their ratings, and hours of utilisation during the day:

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**c) Boilers (and/or Oil Heaters)**

The number of boilers (and/or oil heaters) installed:

Plans for boiler (and/or oil heater) installation or renovation:

Details of boilers (and/or oil heaters):

Boiler ID				
Type				
Steam capacity				
Pressure				
Temperature				
Fuel type				
Quantity consumed				
Steam (or heat) production				
Estimated efficiency				
Water treatment facility				
Water consumption rate				
Percent of condensate re-used				
Maximum steam demand				

\*Steam system diagram (please attach)

**d) Energy Utilisation**

Major energy consuming sections and their energy demands:

---

Size of refrigeration system for process/building cooling (TR):

Air compressors:

Number of compressors: \_\_\_\_\_

Compressor rating: \_\_\_\_\_

Loading / Unloading cycle: \_\_\_\_\_

**e) Additional Information For Energy Auditing**

Please attach the layouts for the following:

- Material flows (in, out, storage)
- Main energy inputs, meters, measuring devices, fuel storage areas
- Main production departments
- Utility equipment (boiler, air compressor, transformer, refrigeration units, cooling water supply, etc.)

**3.7 Energy Management**

Person responsible for energy management (if any):

Name: \_\_\_\_\_

Position: \_\_\_\_\_

Qualification: \_\_\_\_\_

Person responsible for plant maintenance: \_\_\_\_\_

Energy management structure of the plant:

a) "Progress Report" on the energy management: Yes / No

b) Energy Management Committee for the plant: Yes / No

c) Responsibility of the committee: \_\_\_\_\_

d) Formal energy management program in the plant: Yes / No

e) Energy program objectives: Yes / No

### 3.8 Energy Conservation Problems And Activities

Major energy problems as viewed by the plant management:

Indicate area where there are potentials for energy conservation:

The plant's ability to implement recommendations for energy conservation

a) \_\_\_\_\_

b) \_\_\_\_\_

c) \_\_\_\_\_

The decision-making criteria for capital expenditures for energy efficiency projects

a) \_\_\_\_\_

b) \_\_\_\_\_

c) \_\_\_\_\_

Feasibility studies have been conducted for major capital investments?

Yes/No