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Cleaner Production Training

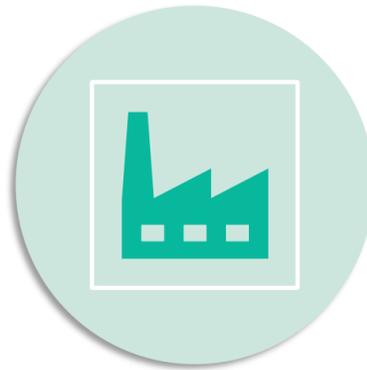
Regina Mwenyango with
guidance from UNIDO

January 2024



Ministero degli Affari Esteri
e della Cooperazione Internazionale

What is Cleaner Production?



It is a general term that describes a preventative approach to industrial activity.



Cleaner production refers to the mentality underlying the production of our goods and services with the minimum environmental impact under present technological and economic limits. It acknowledges that production cannot be perfectly clean.



Cleaner production does not deny growth; it merely insists that growth is ecologically sustainable over a longer time span than economists have traditionally used.

Introduction

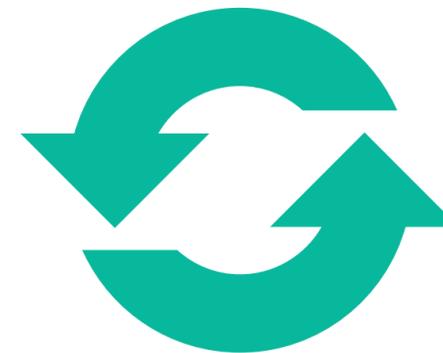
- **Cleaner Production** is an approach to environment management that has many benefits for industry.
- It is most successfully implemented through a systematic life-cycle approach to production that considers:
 - product design
 - low-waste production technologies
 - efficient use of energy and raw materials
 - optimization of existing technologies
 - high standard of operational safety.
- The prevention philosophy of Cleaner Production is the antithesis of the earlier end-of-pipe treatment approach, in which pollution was cleaned up after it had already been generated.



Definition Continued...



For production *processes*, Cleaner Production includes the conservation of raw materials and energy, the elimination of toxic or dangerous materials, and reduction of emissions and wastes at the source.



- For *products*, the strategy focuses on reducing impacts through the entire life cycle of the articles produced, from conception to use, to ultimate disposal.

Why Cleaner Production?



As well as achieving a lower level of pollution and environmental risk, Cleaner Production is also often a good business proposition.



More efficient use of materials and process optimization results in less waste and lower operating costs.



There is often an improvement in worker productivity, with less time lost through illness and accidents.



Can you share more examples of why you think cleaner production is important?

Where is Cleaner Production Applied ?

- Cleaner Production concepts are becoming more popular, but there are some obstacles to its implementation.
- These obstacles are often more an excuse for delay than a legitimate barrier. Experience worldwide shows that the largest obstacle is human conservatism and motivation.
- Information on options and lack of suitable new technologies are some. Occasionally, market constraints force a company to continue to operate an old process, or to manufacture a traditional product, even when newer, cleaner options are available.

Who is Responsible for Cleaner Production?

Although the environmental specialists have an important part to play, the prime responsibility for Cleaner Production does not rest with them. The major contributors are all those who are involved with the production, distribution or consumption of industrial products and services. Clients or suppliers need to be conscious of the implications of their decisions on products.

Plant operators can pay more attention to process optimization, housekeeping and safe chemicals handling. Managers need to give employees incentives to reduce waste.

In industry, individuals can take many preventative actions during their normal day-to-day activities. Technical personnel can best implement the prevention concept when they have access to a clear policy framework, available assessment methodologies (such as environmental performance criteria for industrial products), and knowledge of environmental impacts and alternatives.

Management must, however, enable and encourage the technical personnel to act. Many key decisions that enable Cleaner Production are actually made at the level of corporate management, or during policy development in government. Technical personnel can best implement the prevention concept when they have access to a clear policy framework, available assessment methodologies (such as environmental performance criteria for industrial products), and knowledge of environmental impacts and alternatives.

Implementing Cleaner Production Steps



Step 1: Auditing

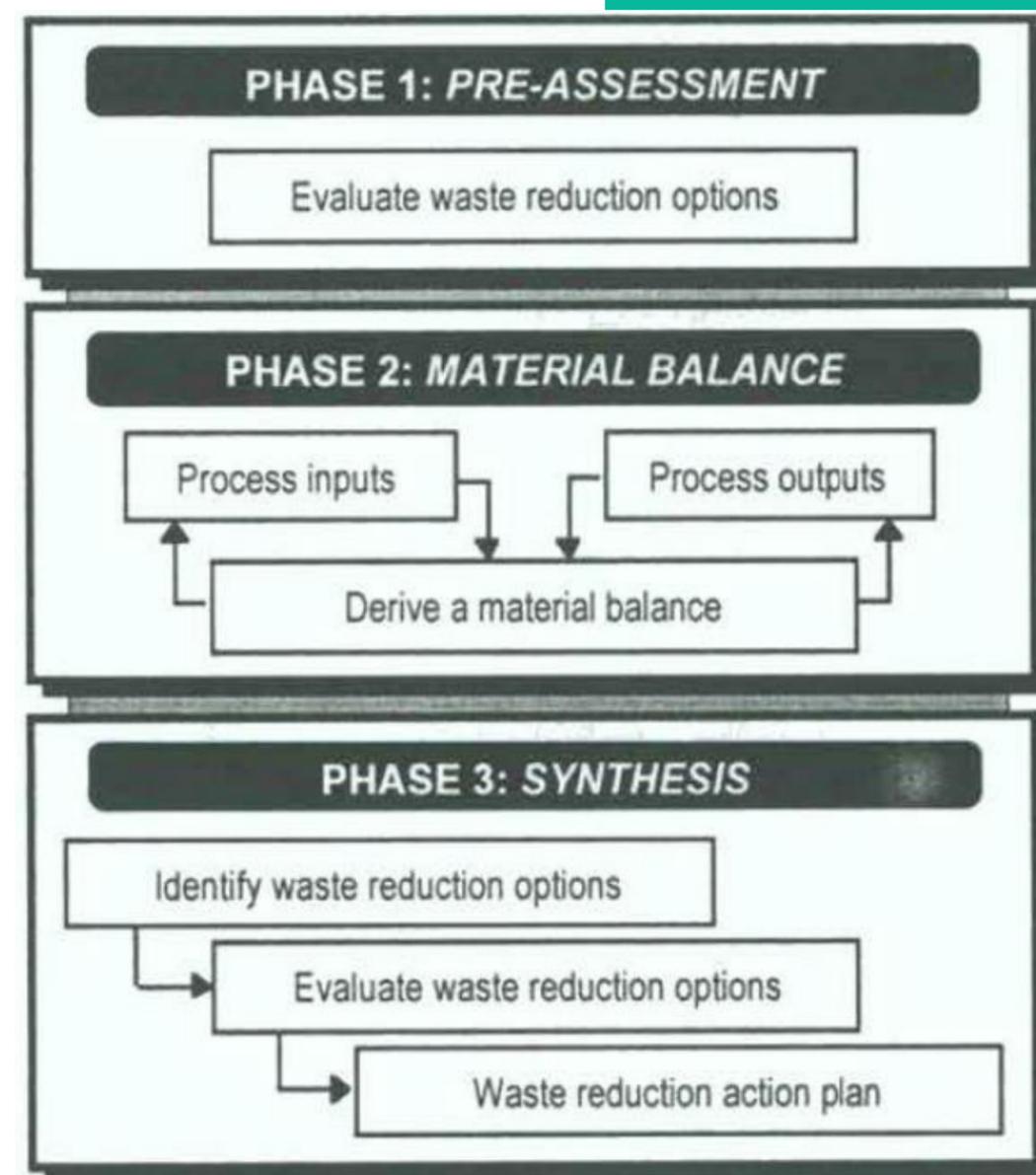
The development of preventative actions can only occur when it is clear what the problem really is. Therefore, the first step is an inventory of waste that is generated in a plant. UNEP and UNIDO have developed a useful diagnostic procedure



The waste audit procedure systematically identifies areas of cleaner production, ensuring that potential preventative actions prioritize addressing the most important sources first.

Waste Audit Procedure

- Preventative options are identified in the synthesis phase of the audit, which is the key to successful remedial action.
- After making a conscious decision to take some action, the management starts the waste audit procedure. The first phase is to form the audit team, discuss the programme with workers and supervisors (who will need to provide much of the data), and document the key processes to be studied.
- It is important to pay attention to psychological aspects of the study because workers may be reluctant to provide information if they believe they will be punished for process inefficiencies.



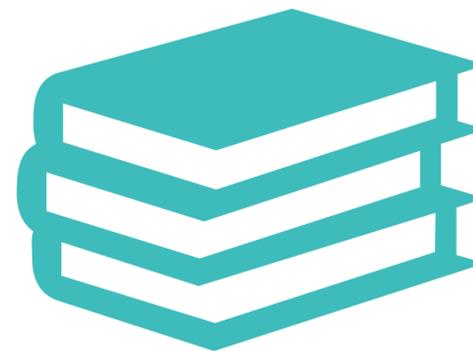
Step 2: Material Balance Phase

From the data provided by plant records and other information, the audit team prepares a Material balance of chemicals, water and perhaps energy. When this material balance is of sufficient quality, it will be possible to determine where the main sources *of waste are*.

Step 3: Synthesis



The *synthesis* phase is where the material balance is studied, and measures are proposed to reduce or prevent loss of materials. It is here that the audit team uses all means possible to identify Cleaner Production options.



The ideas for options may come from:

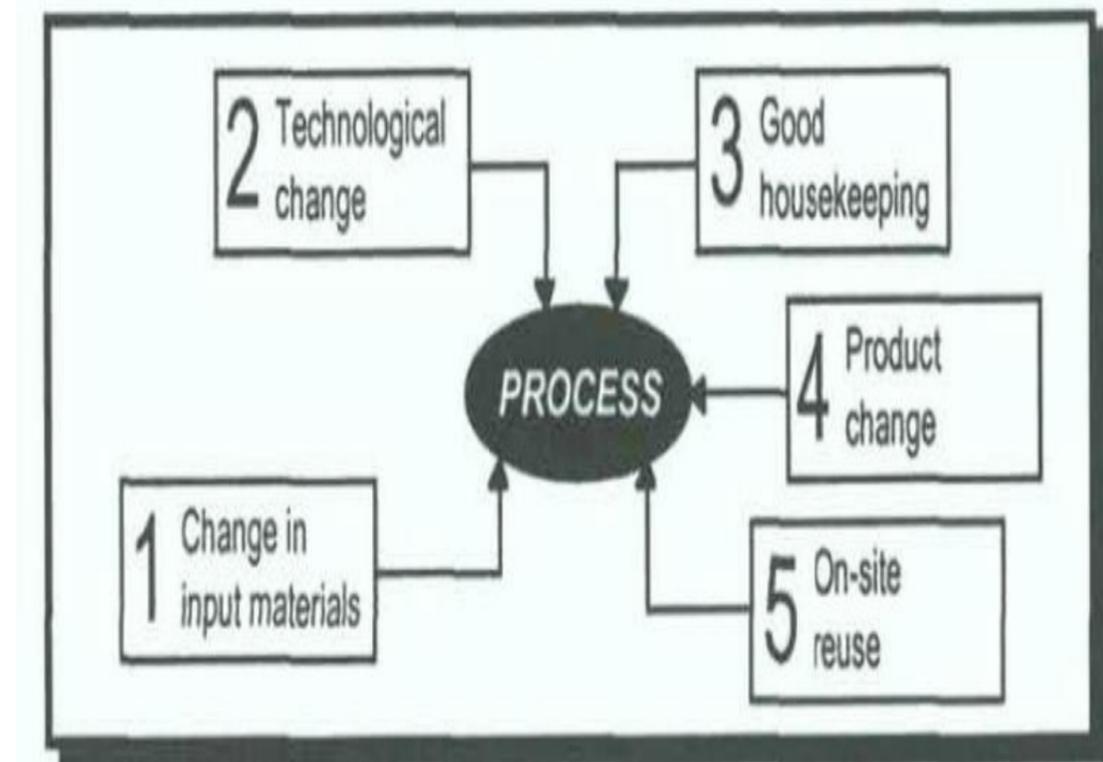
- literature search
- personal knowledge
- discussions with suppliers
- examples in other companies
- specialized databases
- further Research & Development.



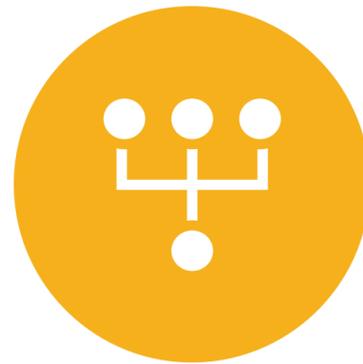
As a creative intellectual environment based on the widest possible experience is often needed in order to think of all possibilities, brainstorming and group sessions are regularly used at this stage.

Point to Note

- It should be noted that, during the audit process, the auditors may have already identified several obvious possibilities for immediate improvements in the figure above.
- It is often helpful to conceptually divide the process into several essential elements to go further, as depicted on the side in process elements for cleaner production.



Change in Input Materials



Input material changes accomplish Cleaner Production by reducing or eliminating the hazardous materials that enter the production process. Also, changes in input materials can be made to avoid the generation of hazardous wastes within the production processes. Input material changes include:



material purification

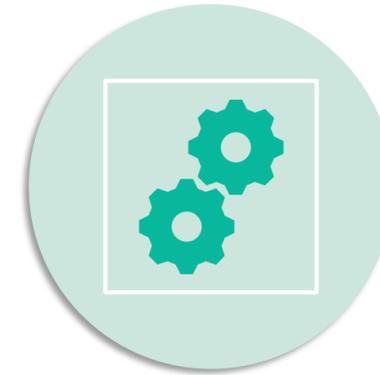


material substitution.

Technological Change



Companies orient technology changes toward process and equipment modifications to reduce waste, primarily in a production setting. Companies can implement technology changes ranging from minor alterations that take a few days and have low costs to replacing processes that require significant capital investment. These include *the* following:



changes in the production process



equipment, layout, or piping changes



use of automation changes in process conditions such as flow rates, temperatures, pressures, and residence times.

Good House Keeping

Good housekeeping implies procedural, administrative, or institutional measures that a company can use to minimize waste. Many of these measures are used in industry, largely as efficiency improvements and good management practices. Good housekeeping practices can often be implemented with little cost. These practices can be implemented in all *areas of the plant*, including production, maintenance operations, and in raw material and product storage.

Good House Keeping Cont.

Good operating practices include the following:

1. Cleaner Production programmes
2. management and personnel practices
3. material handling and inventory practices
4. Loss Prevention
5. waste segregation
6. cost accounting practices
7. production scheduling.



Management and Personal Practices

These
include:

- Employee training
- Incentives and bonuses
- Other programmes that encourage employees to strive conscientiously to reduce waste.

Material Handling Inventory Practices

These include programmes to reduce loss of input materials due to mishandling, expired shelf life of time-sensitive materials, and proper storage conditions.



Loss Prevention

This minimizes waste by avoiding leaks from equipment and spills.



Waste Segregation Practices

This reduces the volume of hazardous wastes by preventing the mixing of hazardous and nonhazardous wastes. non-hazardous



Cost Counting Practices

To include programmes to allocate waste treatment and disposal costs directly to the department or groups that generate waste, rather than charging these costs to general company overhead accounts. In doing so, the departments or groups that generate the waste become more aware of the effects of their treatment and disposal practices, and have a financial incentive to minimize their waste.



Scheduling of Batch Production Runs

By judicious scheduling of *batch production runs*, the frequency of equipment cleaning and the resulting waste can be reduced. It is at this stage also that the energy efficiency of the process, and of the general plant operation, can be considered.

Product Changes

The manufacturer of a product performs product changes intending to reduce waste resulting from a product's use. Product changes include:

1. Product substitution
2. Product conservation
3. Changes in product composition.

Onsite Reuse



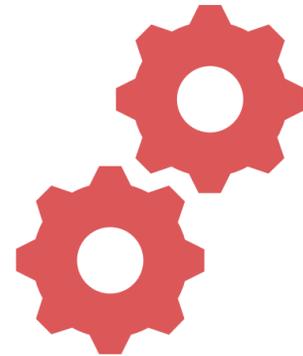
Recycling via use and/or reuse involves the return of a waste material either to the originating process as a substitute for an input material, or to another process as an input material. After the options have been generated, an initial selection should be made, considering:

availability
suitability
environmental effects
economical feasibility.

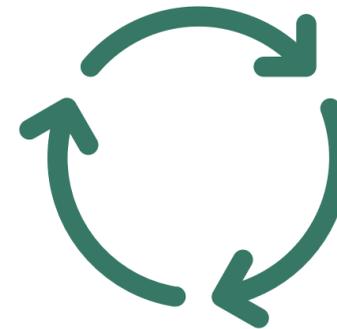


This initial selection should take place before the Cleaner Production option is submitted to more thorough evaluation. During the *feasibility phase*, the evaluation will cause a selection of options for implementation.

Monitoring of Changes



The implementation phase of the options has to be followed by monitoring of the changes, and - inherent to the concept of Cleaner Production - followed by a new audit, which will be used to identify new options for Cleaner Production.



This last step closes the chain of continuous improvement.

Different Arenas of Cleaner Production

	Arenas	Topic
1	<i>The company</i>	<i>Problem analysis and solution</i>
	<ul style="list-style-type: none"> • employers • employees 	<ul style="list-style-type: none"> • responsibility and internal control • prevention teams and organization • change in work routines • participation and influence
2	<i>The network of the company</i>	<i>Reduction of 'aspect blindness'</i>
	<ul style="list-style-type: none"> • consultants • suppliers • educational institutions • trade unions 	<ul style="list-style-type: none"> • cleaner working procedures • cleaner process technologies • changes in design and construction • clean technologies • learn prevention strategies • new courses and further training • working conditions versus environment • 'cleaner' wage-bargaining system • diffusion of knowledge about prevention
3	<i>The authorities</i>	<i>Dynamic regulation</i>
	<ul style="list-style-type: none"> • municipality • county • state 	<ul style="list-style-type: none"> • green wastewater plan • health and safety • environmental certification • trade agreements/action plans • initiate the innovation of clean technologies
4	<i>The public</i>	<i>Enlightenment and democratic debate</i>
	<ul style="list-style-type: none"> • citizen • media 	<ul style="list-style-type: none"> • motivation to prevention • change of consumer behaviour • information and debate

Cleaner Production Tools



Waste Audit



A *waste audit* is a thorough account of the wastes from an industry, a plant, a process or a unit operation. A waste audit requires the derivation of a material balance for each scale of operation. The waste audit should result in the identification of wastes, their origin, quantity, composition and their potential for reduction.

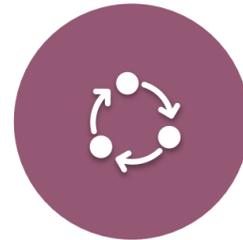


Other frequently used terms, using more or less the same approach and objectives, are *Waste and Emission Audit*, *Waste and Emission Prevention Assessment*, and *Waste Minimization Audit*.

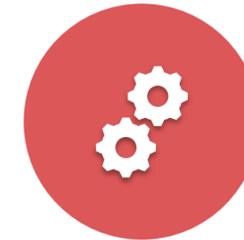
Waste Audit: A good audit does the following;



defines the sources, quantities and types of waste being generated



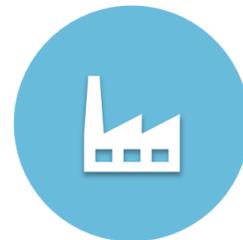
collects information on unit operations, raw materials, products, water usage, and wastes



highlights process inefficiencies and areas of poor management



helps to set targets for Cleaner Production



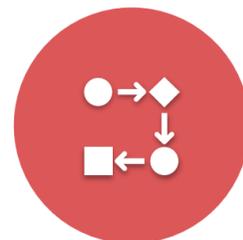
permits the development of cost-effective waste management strategies



raises awareness in the workforce regarding benefits of Cleaner Production



increases knowledge of the process



helps to improve process efficiencies.

Energy Audit

An *energy* audit identifies the costs and physical quantities of energy inputs used, the annual and seasonal trends in energy use and cost, and the energy use per unit of output.

A Good Energy Audit

The energy audit should be part of an energy management programme aimed at reducing the overall cost of energy use per unit of output. An energy audit must be conducted in line with management policy, developed as part of the energy management programme. A good energy audit:

1. defines the sources, quantities, and cost of energy being used
2. collects information on energy usage per unit operation
3. highlights process inefficiencies *and areas of* poor management
4. helps to set targets for energy saving
5. permits the development of cost-effective energy strategies
6. raises awareness in the workforce regarding costs of energy consumption.

As a result of the audit, a plan of action is formulated and implemented, followed by evaluation and continuous improvement of the energy management program. The Energy management programme follows the same lines as the procedure for a waste audit procedure.

Risk Audit

This identifies all areas of vulnerability and specific hazards at site and plant level, and examines and assesses, the standards of all facets of a particular activity.

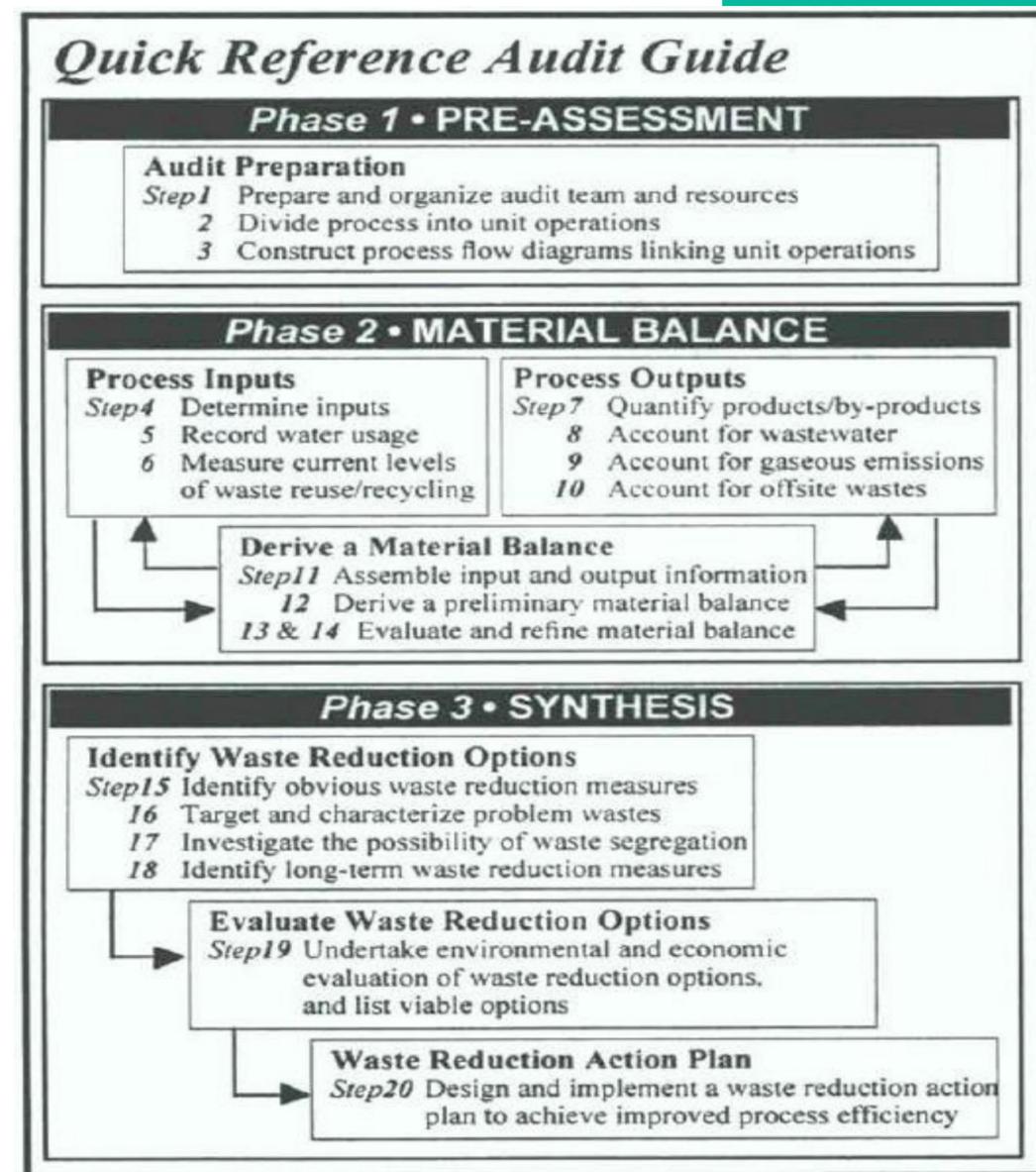


A Risk Audit

has five main elements:

1. identification of possible materials loss producing situations
2. assessment of potential losses associated with these risks
3. selection of measures to minimize materials losses
implementation of these measures within the organization
4. monitoring of the changes effected.
5. As a result of the audit, a plan of action is formulated and implemented, followed by evaluation and continuous improvement of the risk management program.

Exercise: Audit Guide



Information Sources

Company Data for a Waste Audit

General Information

- Company environmental policy documents
- Standard procedures
- Organization charts

Raw Materials/Product Information

- Product composition and batch sheets
- Overviews of raw materials and input material applications (including energy)
- Fact sheets on product safety aspects
- Product and raw material inventory records
- Operator data logs
- Operating procedures
- Production schedules



Thank you



19th Floor Jeongdong Bldg. 21-15,
Jeongdong-gil, Jung-gu, Seoul,
Republic of Korea 04518

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