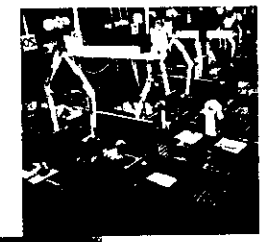
Republic of Lebanon

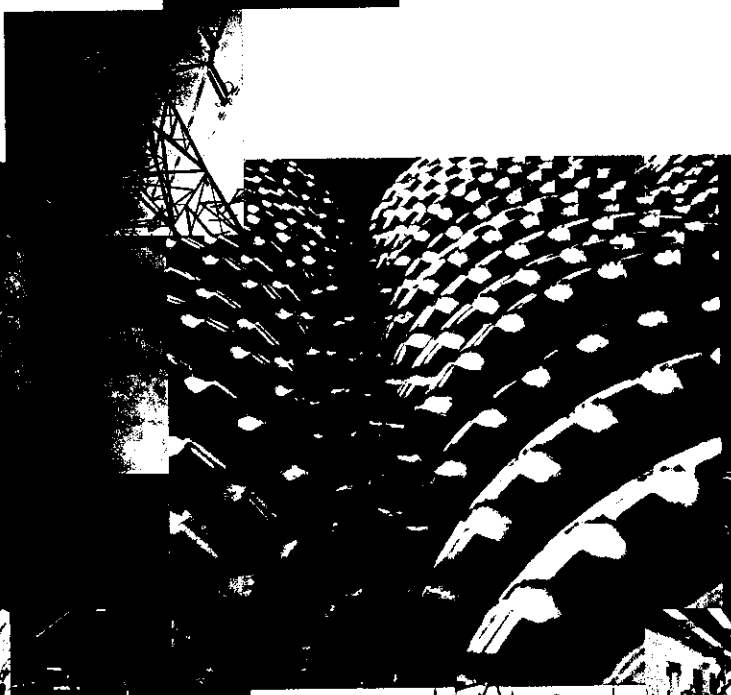
Office of the Minister of State for Administrative Reform

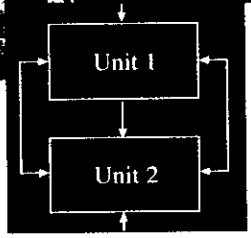
Center for Public Sector Projects and Studies

(C.P.S.P.S.)

National Environmental Auditing Manual







الجمهورية اللبنانية

مكتب وزير الدولة لشؤون التنمية الإدارية

مركز مشاريع ودراسات القطاع العام

Republic of Lebanon
Ministry of Environment

Strengthening the Permitting & Auditing System for Industries

European Union
Life 3rd Countries Programme

United Nations
Development Programme

PREFACE

With the dawning of the 21st century, the Lebanese industrial sector is faced with many challenges. International trade markets are becoming freer, thus removing tariff barriers between countries. This trend requires industries in developing countries to abide by more stringent environmental standards in their production processes to enable their expansion into international markets. Consumers and manufacturers in most developed countries (e.g. in Western Europe, North America) demand the adoption of Ecologically Sustainable Industrial Development (ESID) and the manufacturing of "eco-friendly" products. This challenge is to be met mainly by adopting integrated pollution prevention methods and by adhering to stringent environmental standards at the industrial level.

Lebanon has signed many bilateral trade liberalisation agreements namely with Syria, Egypt and Kuwait in addition to other multilateral agreements such as the Arab Free Trade Agreement of January 1998. Furthermore, Lebanon is in the final stages of negotiations with the European Union (EU) leading to the ratification of the Euro-Med Association Agreement. It is also holding World Trade Organisation (WTO) accession negotiations. These agreements have bound Lebanon to improving the quality of its production processes to be able to compete with other countries.

In the meantime, Lebanon is dealing with other problems facing its industrial sector. Some of these problems are the high production costs and the vulnerability of the industrial sector to competition in cost and quality, due to the economies of scale of foreign countries.

By adopting cleaner production methods as part of a comprehensive pollution management system, the Lebanese market will acquire a competitive edge in the Arab and international markets, leading to financial and economic savings, improved environmental performance and improved product quality.

Conducting environmental audits in Lebanese industrial facilities is, therefore, one of the ways of optimising resource use and improving process performance. It will facilitate the adoption of cleaner production methods, eco-labelling and environmental management systems. It will, accordingly, lead to the fulfilment of environmental directives stated in several agreements signed by Lebanon in a manner that is sustainable and supportive to industrial development and growth.

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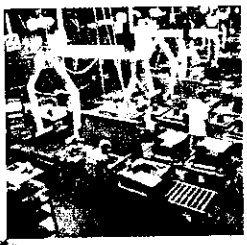
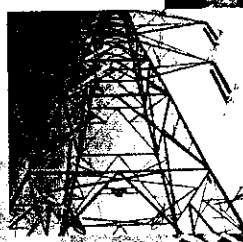
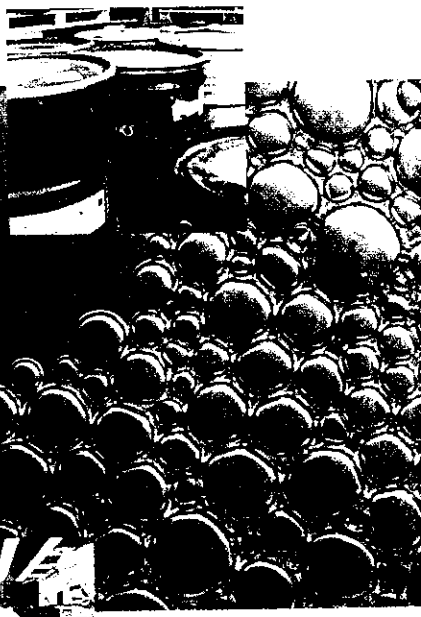
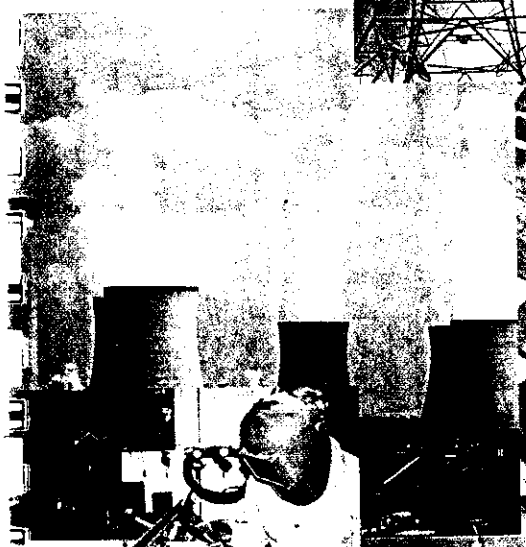
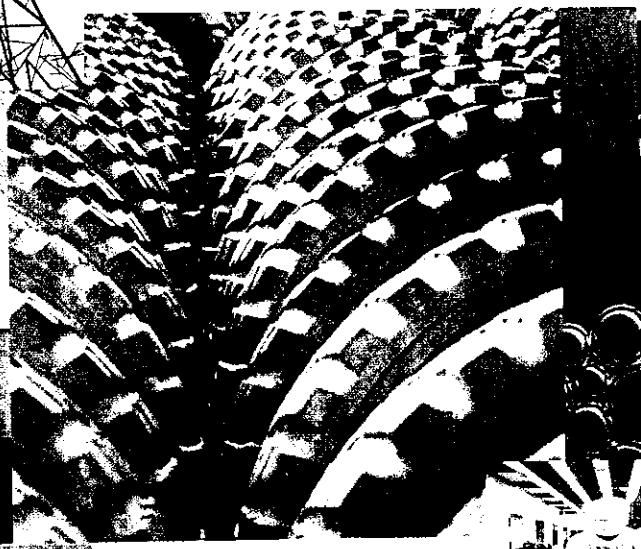
ENVIRONMENTAL AUDITING: Definition & Methodology

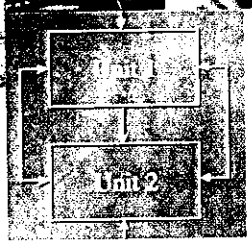




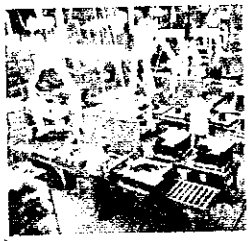


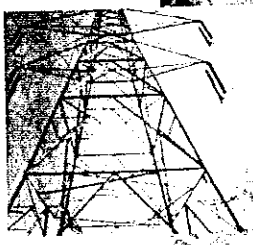


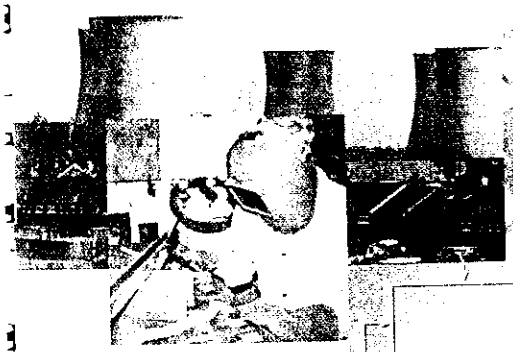




ENVIRONMENTAL AUDITING: Definition & Methodology







CHAPTER 1: Introduction

1.1 DEFINITION OF AN ENVIRONMENTAL AUDIT

An environmental audit is a ***systematic, detailed, documented, periodic and objective process***, which assesses a facility's operation regarding the ***environment, safety and health***. It is the first step in an on-going programme, which entails documentation, implementation and continuous follow-up of the action plan produced by the audit to ***optimise resource use and improve process performance***.

Audits differ from casual assessments in that they incorporate statistical inspection, direct investigation and elaborate data collection. Assessments on the other hand are less elaborate.

1.2 THE DIFFERENT TYPES OF AUDITING

There are many different types of audits. Each one of them responds to a different need. The following are the basic types of environmental audits:

1.2.1 Compliance Audits

A compliance audit investigates the compliance of the facility with environmental legislation and regulations. It identifies gaps in the compliance that should be addressed. In brief, it is an inspection that incorporates a permit review.

1.2.2 Waste Audits

In a waste audit the material flow and the processes within a facility are investigated for the purpose of resource optimisation and efficient process performance.

A good waste audit should cover the following:

- Sources, quantities and types of waste generated;
- Information on the raw material used, unit operations, products, by-products and water usage;
- The definition of process inefficiencies and poor management areas to suggest ways of improving them;
- The establishment of goals for waste reduction;
- The development of a cost-effective waste management strategy;
- The enhancement of staff awareness relative to waste reduction advantages.

1.2.3 Risk Audits

A risk audit investigates the different risks that may arise from the facility leading to environmental contamination. It identifies the source of contamination, the possible routes for leaving the facility and the consequent receptors. It is usually used to prevent accidents and catastrophes.

1.2.4 Environmental Management Audits

This type of audit assesses whether an appropriate compliance management system has been established, implemented and properly used to introduce environmental compliance in daily operations.

1.2.5 Environmental Liability Definition Audits

The purpose of this audit is to identify environmental problems that affect the value of the property or expose the buyer to liability.

1.2.6 Waste Contractor Audit

A waste contractor audit combines aspects of the compliance and liability definition audits to analyse commercial facilities used to store, treat and dispose of hazardous waste.

1.3 NATIONAL ENVIRONMENTAL AUDIT

In an effort to unify the auditing procedures and methods conducted by the private sector in Lebanon, the Lebanese Ministry of the Environment has designed this detailed audit manual covering the main aspects of environmental issues in operating facilities. The manual is to be used either to **conduct a thorough audit or to cover a specific environmental objective**. Accordingly, it provides the guidelines and procedures for conducting audits in Lebanon ***and could be tailored*** to fit the different needs of various sectors. Thus, the manual thoroughly covers the following issues:

- Environmental management practices;
- Processes used;
- Water consumption;
- Wastewater generation;
- Air quality and gaseous emissions;
- Solid waste generation;
- Noise pollution;
- Energy consumption;
- Occupational health and safety.

1.4 OBJECTIVES OF THE NATIONAL ENVIRONMENTAL AUDIT

Some of the main objectives of the national audit manual are listed below:

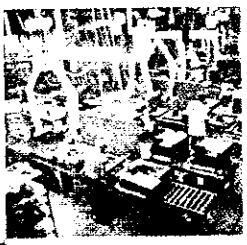
- To assess compliance with government legislation, regulations, guidelines, codes of practice and permit conditions;
- To assess adherence to internal policy and procedures;
- To assess the current practice status;
- To identify areas of improvement to minimise the impact on the environment.

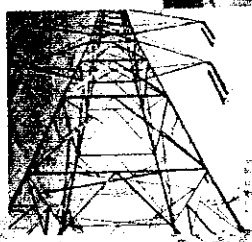
1.5 BENEFITS OF ENVIRONMENTAL AUDITING

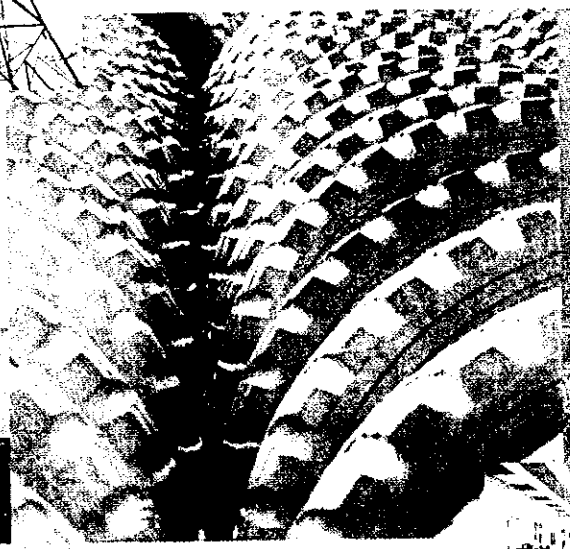
The benefits of environmental auditing include the following:

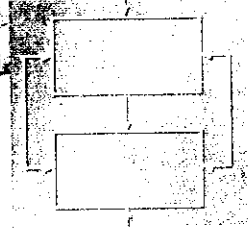
- Promotes good environmental management;
- Ensures cost-effective compliance with laws, regulations, standards and company policy;
- Increases employee productivity and awareness and safety at work;
- Reduces operation costs;
- Incorporates the environmental dimension in a facility's operation;
- Triggers new priorities in policies and practices;
- Improves the image of the facility and enhances competitiveness;
- Leads to the provision of a certification from the Ministry of the Environment.

ENVIRONMENTAL AUDITING: Definition & Methodology





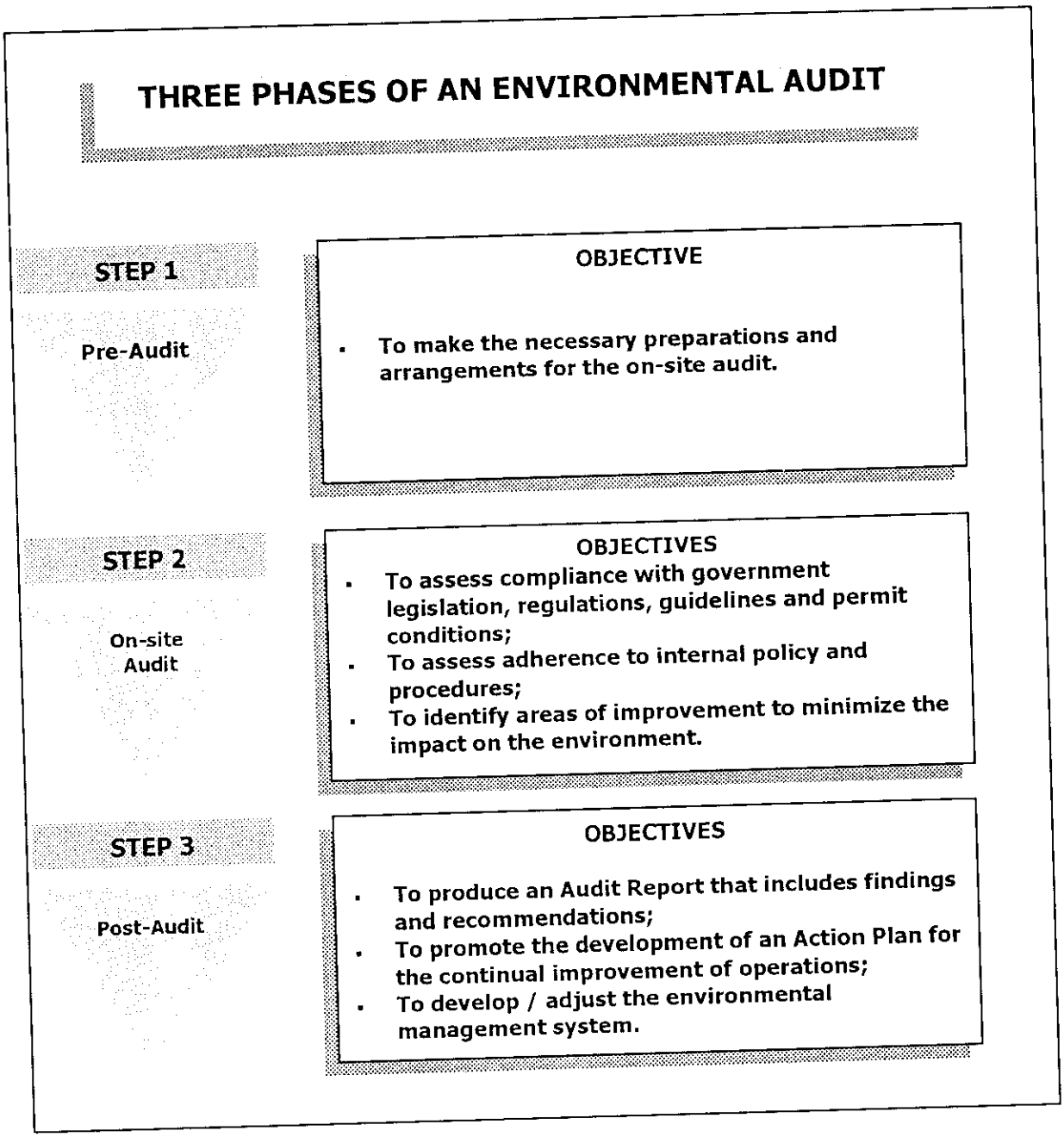




CHAPTER 2:
The Audit Procedure

2.1 PHASES OF ENVIRONMENTAL AUDITING

There are three phases to an environmental audit. The following diagram illustrates these different phases.



2.2 Audit Phase Depiction

2.2.1 Phase 1: Pre-Audit - Audit Planning and Preparation

This first phase involves the following actions:

a. Setting objectives and scope;
b. Forming and organising the audit team;
c. Overview of the type of facility;
d. Visiting top management;
e. Conducting detailed background research;
f. Tailoring the pre-audit questionnaire;
g. Tailoring of checklists;
h. Assigning tasks, responsibilities and a timetable.

TIPS

The pre-audit phase is of utmost importance for the success of the audit. Thorough preparation will ensure cost effectiveness and efficiency.

a. Setting objectives and scope

The objectives of the audit should state clear, measurable targets and deadlines so as to increase effectiveness in assessing progress. The audit may cover a complete process or a selection of unit operations. The objectives of the audit could be to comply with air, water, or waste discharge standards. The audit may aim at correcting specific environmental problems, improving occupational health conditions, minimising waste production, increasing efficiency or minimising the waste of resources.

The stated objectives will help in defining the scope of the audit. If the objective of the audit is to minimise air pollution so that it complies with governmental standards, then only equipment and processes that generate air emissions will be encompassed in the scope of the audit.

b. Forming and organising the audit team

The audit team should consist of people familiar with the facility processes, the relevant environmental regulations and the environmental management practices. The team is usually appointed by the audit team leader who sets the terms of reference for the team members. The team may consist of internal or external consultants. The size of the team depends on the size of the facility to be audited. A small company may require few persons while bigger facilities could entail more technical staff, production employees and environmental specialists. The facility employees should be involved in

the different steps of the process as much as possible to increase their awareness and ensure their involvement and support and hence the success of the audit. Production engineers and line operators are the best providers of information on equipment operation, material usage and maintenance and safety practices. As to the attributes of the team leader, they should be the following:

- Accustomed to the facility's products and departments;
- Knowledgeable of the different operations of the facility;
- Familiar with the different environmental principles such as waste minimisation;
- Acquainted with environmental regulations;
- Experienced in analysing technical data;
- Equipped with good communication skills.

External resources may be needed in the audit such as laboratories, sampling equipment and flow measurements, or technical expertise from specialists, consultants, or analytical service organisations. The following table presents an example of audit team organisation, team members' responsibilities and expected outputs.

Example of Environmental Audit Staffing

Name	Responsibilities	Outputs
Audit Team Leader	Briefing and gaining the support of the management	Committed management
	Meeting with staff	Gained staff support and commitment
	Setting TORs for the audit team members	Defined roles, responsibilities and scope
	Working with the team in planning for the audit	Set audit plan
	Working with team in conducting the audit	Completed checklists
	Analysing audit results together with the team	Elaborate audit action plan
Technician **Chemical Engineer** **Plant Manager** **Process Engineer**	Analysing environmental management strategies	Identified strategies and gaps
	Analysing production process	Characterised material balance
	Analysing water supply	Characterised water quality and consumption
	Analysing wastewater generated	Identified wastewater characteristics and quantities
	Analysing air quality	Identified air pollutant levels and characteristics
	Analysing solid waste	Identified solid waste characteristics and quantities
	Assessing noise pollution levels	Labelled noise pollution
	Analysing energy use	Defined energy consumption sources
	Analysing risks	List of hot spots
Industrial Hygienist	Observing occupational health and safety	Identified occupational health issues
Legal Advisor	Explaining regulatory demands, legal assessments	Audit plan, report and liability

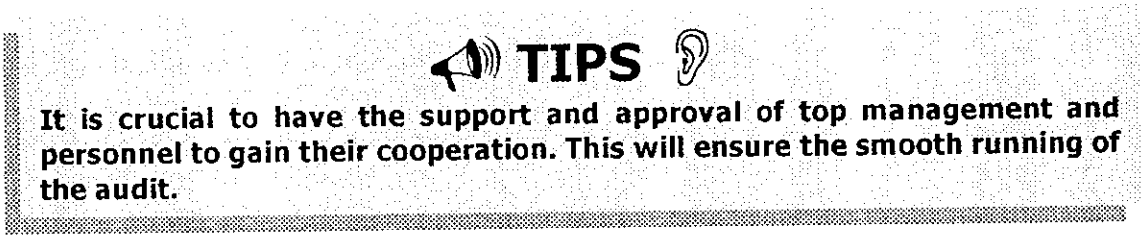
c. Overview of the type of facility

This is to identify the major processes and environmental problems associated with that particular industrial sector. It entails reviewing relevant information pertaining to the different operational activities and processes involved, waste produced and materials utilised. This enables the creation of a picture of the facility prior to the visit, facilitating the on-site inspection.

d. Visiting top management

The purpose of this visit is to gain the support and commitment of top management. It entails:

- Presenting the objectives and scope of the audit;
- Introducing the audit team members;
- Outlining the audit approach and methodology;
- Addressing concerns;
- Asking for an in-house representative, preferably the plant manager, to aid in the implementation of the audit.



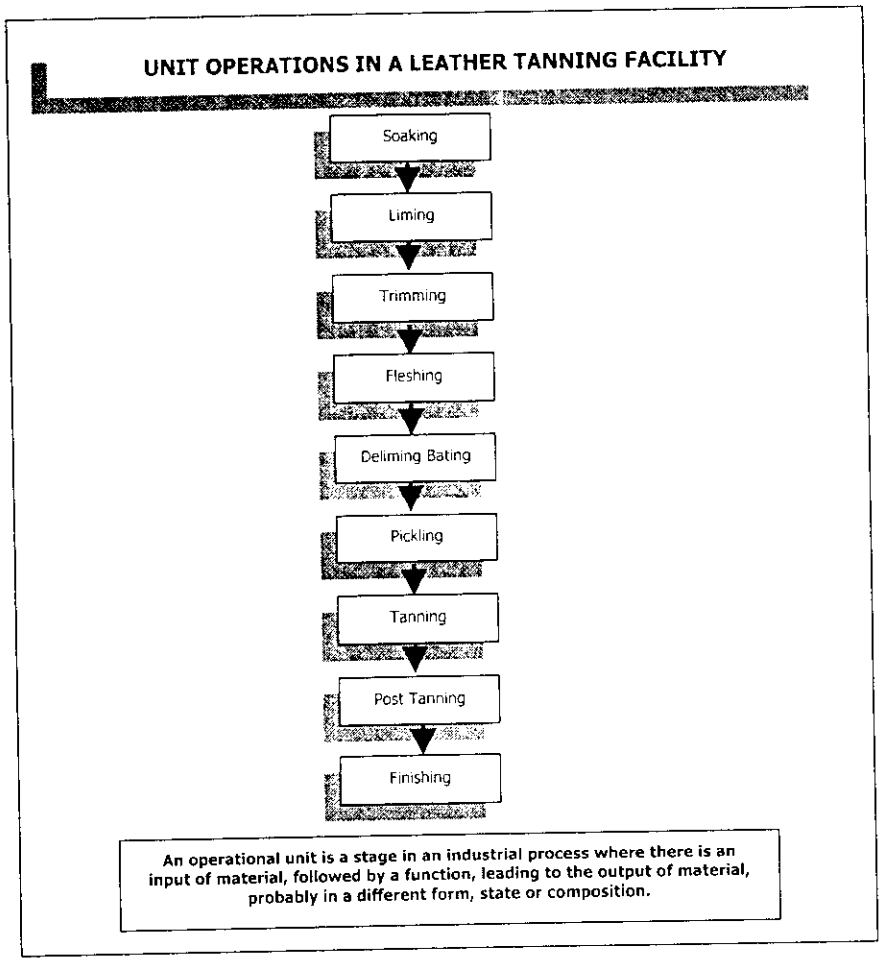
e. Conducting detailed background research

This information serves as a reference for decisions related to process and product changes. Information is gathered through internet searches, preliminary interviews, an initial site visit, reviews of handbooks and source books encompassing the following topics:

- Information about geographical site location (major nearby ecological sites or residential areas);
- Operational information and the unit operations of the process;
- Process flow diagrams linking the different operational units;
- Major common problems related to production processes;
- Reviewing information on the quality of the pollution in different stream(s) possibly generated and other environmental information related to that particular industry;

- Information on possible raw materials that could enter the process, product composition and processes involved;
- Methods of pollution control, waste treatment and disposal.

The following example shows the different operational units of a leather manufacturing company.



f. Tailoring and filling in a pre-audit questionnaire

The purpose of this questionnaire is to accumulate information relevant to the audit site before conducting the audit. This information aims at familiarising the audit team with the site operations. For a detailed environmental audit, the pre-audit questionnaire should provide an overview of the following information:

- Facility and premises;
- Employees and shifts;
- Legal status;
- Environmental management;
- Process management;

- Energy consumption;
- Water consumption;
- Wastewater generation;
- Solid waste generation;
- Air quality monitoring and control;
- Staff awareness;
- Raw material and product.

The pre-audit questionnaire is usually filled in by the audit team members and the plant manager. For a sample copy of a pre-audit questionnaire, please refer to Annex I "Pre-Audit Questionnaire".

g. Tailoring of the checklists

Checklists are used in the on-going audit stage to ensure consistency and uniformity in data collection. Tailoring should occur to allow the adaptation to the specific nature of the actual site audited. There are different checklists for various environmental issues. These checklists cover the following areas:

- Environmental management;
- Production processes;
- Water supply;
- Wastewater management;
- Air emissions;
- Solid waste management;
- Noise pollution;
- Energy consumption;
- Occupational health and safety.

All the above-mentioned checklists are supplemented in Annex II "Full Audit Questionnaire" of this manual.

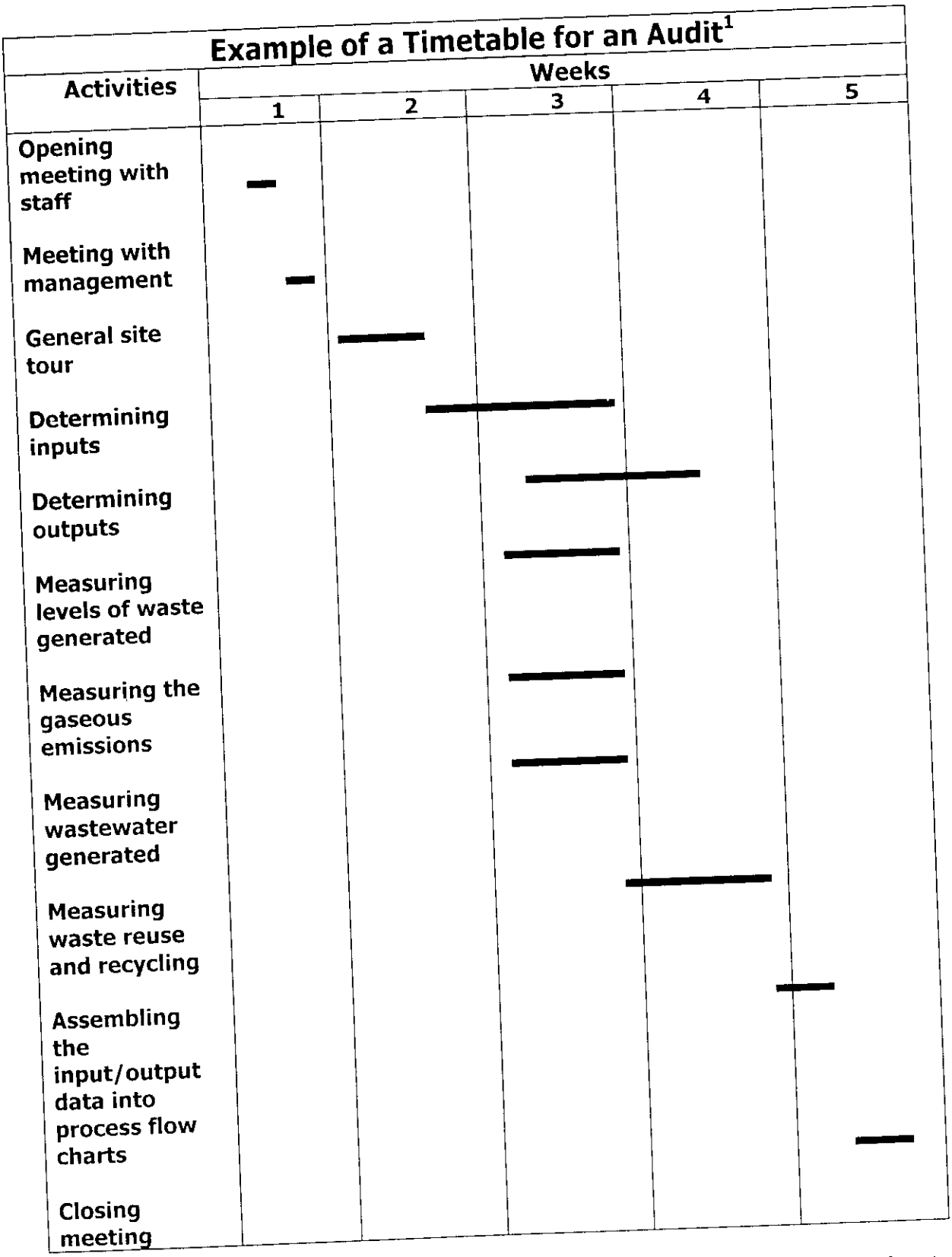
h. Assigning tasks, responsibilities and a timetable

At the end of the first phase, the "Pre-Audit", the audit team should have come up with an audit plan, which includes background information, audit checklists and a timetable for the on-site audit. Please see the example on the next page.

TIPS

The findings of phase 1 could be presented to the management in the form of a pre-audit report to reaffirm their support before proceeding with the next phase.

Example of a Timetable for an Audit[1]



[1] This is an example of an audit timetable, which will differ according to the different operations, processes and preliminary assessment.

2.2.2 Phase 2: On-site Audit

The second phase involves the following actions:

a. Opening meeting with staff;
b. Assessing the legal status and environmental management;
c. Detailed on-site inspection;
d. Data analysis;
e. Closing meeting.

a. Opening meeting with staff

The purpose of this visit is to gain the support and commitment of the staff.[2] It entails:

- Explaining to the staff the scope, purpose and benefits of the audit;
- Encouraging questions and addressing concerns;
- Introducing the audit team members;
- Introducing the areas of intervention (process, wastewater, energy, etc.).

TIPS

The audit team members should:

- **Introduce themselves, present the audit, its background and objectives appropriately;**
- **Listen carefully to what the facility staff have to say;**
- **Leave conclusions until a later stage of the meeting.**

This meeting should not exceed 60 minutes.

b. Assessing legal status and environmental management

To assess the legal status and environmental management in the facility, the following actions should be undertaken:

- Overviewing legal status of the facility with the management such as the type of permits available, their validity, date and source of issuing;

[2] Annex IV "National Environmental Auditing Manual" provides a set of slides with a short introduction of the environmental audit approach for staff members.

- Addressing compliance related issues;
- Assessing the actual environmental situation at the management level;
- Finding information on existing environmental policies, awareness of any existing environmental regulations concerning that particular industry, existing monitoring activities, inventory management, hazardous material management, the presence of environmental training programmes, challenges faced and future plans.

The information gathered will help in developing recommendations for better environmental management.

c. Detailed on-site inspection:

This entails filling in the audit checklists supplemented in Annex II "Full Audit Questionnaire". The checklists will provide information on the following topics:

c1 Production process;
c2 Water supply;
c3 Wastewater generation;
c4 Air emissions;
c5 Solid waste generation;
c6 Noise pollution;
c7 Energy consumption;
c8 Occupational health and safety.

c1. Production process[3]

This provides information on the input, consumption and output materials of the different operational units, processes and the facility as a whole. This will lead to the final calculation of the material balance. Inputs into the material balance include raw materials, chemicals, water, air and energy used. The material balance should also account for reused and recycled inputs. All losses through evaporation, spillages, leakages and contamination of raw materials at the storage and transfer stages should be balanced, too. Outputs include the products, by-products, air emissions, wastewater and solid waste generated.

The material balance provides the audit team with a quantitative and qualitative understanding of the operation and serves as a starting point for identifying process inefficiencies and waste reduction options.

[3] The following production process checklist is to cover all environmental issues such as wastewater generation, solid waste generation, air emissions, water supply, etc. Thus topics related to the production process and covered in this section will not be repeated in the other checklists. The other checklists refer to components not used in the production process, but encountered within the facility.

Quantification should be achieved through direct inquiry from the plant manager and through in-situ measurements. Accordingly, both theoretical and practical information will be gathered by the audit team, allowing the identification of the variations and the possible reasons behind them.

TIPS

Infrequent outputs such as occasional dumping can be as significant as continuous daily discharges.

Measurements should be taken for an appropriate length of time. For example, if a batch requires one week to run, then at least a three-week measurement should be taken.

For solid input materials and waste, the plant manager should provide data on their respective weights and the information should be validated by on-spot weighing.

As for liquid inputs and waste, a similar approach should be conducted. Flow meters are useful at this stage to quantify liquid inputs and outputs.

The input data should be recorded on the process flow diagram and in a tabular form. The same flowcharts are used in the pre-audit and the audit phases. The only difference is that the pre-audit flowcharts collect theoretical data, whereas the audit flowcharts are based on actual measurements. Discrepancies detected between the two flowcharts indicate areas to focus on.

c2. Water supply

The water supply checklist covers mainly the use of water for non-process purposes, while water used for process purposes would have been covered in the process checklist. The above-mentioned checklist includes the consumption rate of water used to wash, rinse, cool, etc.

In addition, it identifies the different sources of water used whether it is well water, municipal water, surface water or another type of water. Furthermore, the water quality will be investigated and an inquiry into any treatment measures will be made. If applicable, the type of pre-treatment and the presence and validity of permits for the extraction of water from nearby water bodies will be examined.

The information gathered from the checklists will help identify areas where tighter control on water use can lead to the reduction of the volume of wastewater requiring treatment, thus leading to cost savings.

TIPS

Remember, the compilation of accurate and comprehensive data is essential for a successful audit. The audit team leader has to ascertain that each step is completed and that the appropriate data gathering method has taken place.

c3. Wastewater generation

In many industries, both clean and contaminated water is directly discharged into sewers or a nearby body of water. Therefore, it is crucial to know the amount of wastewater going down the drain as well as its contents.

Excluding process wastewater, which would have been covered previously, the wastewater checklist gathers information on the sources of wastewater, their discharge points, treatment methods, overall monitoring data, legal issues, etc.

c4. Air emissions

Excluding the case of air emissions resulting from the production process, this checklist is necessary to account for all sources of gaseous emissions ranging from raw material storage, to the auxiliary equipment used such as boilers, furnaces, generators, storage, etc. The checklist also addresses air quality monitoring and mitigation actions taken.

c5. Solid waste checklist

The minimisation of waste will directly lead to eco-efficiency[4]. Accordingly the solid waste checklist is designed to gather information on the quantity of waste, its composition, management practices (e.g. reuse, recycling), treatment, storage and ways of disposal.

c6. Noise pollution

This checklist aims at quantifying the noise levels at the different unit operations and the overall noise level at the facility. Any noise reduction measures are also assessed.

c7. Energy checklist

The energy management checklist provides information on energy use at the facility and its source. It also identifies the main energy consuming departments and equipment, electricity consumption, fuel consumption, renewable energy usage and any strategies to reduce energy consumption.

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[4] Eco-efficiency is the environmental way of operating.

TIPS

Always write down information gathered, comments and notes before leaving the site and avoid relying solely on memory.

c8. Occupational health and safety

This checklist deals with employees' health and safety, existing conditions, personal protective equipment provided for the workers, its intended use, maintenance, storage areas, emergency response procedures, employee exposure monitoring and the safety rules available at the facility. In addition it identifies whether safety-training programmes are implemented, their frequency and levels.

d. Data analysis

The data collected from the pre-audit questionnaire, interviews, inspection checklists and notes should be reviewed and analysed on a daily basis and at the end of data collection phase by the different audit team members. This will ensure consistency and accuracy of information. This stage may require visiting the industrial facility again to collect additional information and fill in gaps that may have appeared during analysis, or to double check a certain measurement. (If outputs, for example, were found to be less than inputs while conducting a material balance, then there may be losses or waste discharges such as evaporation that has to be checked.)

TIPS

In a material balance, inputs should ideally equal the outputs but this is rarely the case. Some judgment will be required to determine what level of accuracy is acceptable.

All findings and observations should be summarised and documented. Issues that require immediate intervention should be identified. At this stage, material should be prepared to debrief the management in the closing meeting.

By the end of the second phase, the auditors should have gathered information covering the previously set objectives such as process inputs and process outputs, the

wastewater and solid waste quantities generated. This data will form the basis of the action plan to be developed in the third phase.

e. Closing meeting

This meeting involves the following:

- Debriefing the management on the findings;
- Highlighting the strengths and weaknesses;
- Involving the management in suggesting corrective actions;
- Stating areas that require immediate attention;
- Clarifying outstanding issues;
- Answering staff questions and concerns;
- Elaborating the next steps.

TIPS

In the closing meeting:

- **Do not linger on negatives;**
- **Do not argue;**
- **Acknowledge the help of the personnel;**
- **Start with the positive;**
- **Listen attentively;**
- **Discuss all findings;**
- **Involve the management and staff in suggesting corrective actions.**

2.2.3 Phase 3: Post-audit

This phase focuses on the final stages of the audit and covers the following two issues:

a. Audit Report;
b. Action Plan.

a. Audit Report:

The data gathered should be organised into an audit report. The report should summarise the findings and the recommendations.

After the finalisation of the first draft, it should be circulated to the management, facilitators and personnel to receive their feedback.

The audit report should deal with deviations from environmental standards, areas of unexplained losses and areas where the flow exceeds national or site discharge regulations. Some improvements can be applied cheaply and quickly such as improvements in housekeeping procedures or management techniques. Other improvements are long term and may involve process modifications or equipment installations. The action plan will deal with these modifications.

The following is a suggested methodology for writing an audit report.

a1. Contents

a.1.1 Introduction: This part includes the background of where the audit took place and why, when and who performed it. It should include the objectives and scope of the audit. It should explain the procedures and the standards used to measure performance.

a.1.2 Site description: This part summarises the plant layout and operations, focusing on any environmental issues concerning the facility such as discharge into nearby water bodies.

a.1.3 Results: Here the findings could be grouped according to the different operational units, or environmental media, or the severity of environmental violations (by comparing the concentration of chemicals in wastewater or air emissions to standards). The report writers should decide on the grouping that best suits the facility.

It is very important that the findings are well organised. If the findings are grouped as per the operational units, then within each unit there could be information on the source of pollution, the applicable standards and the control practices. A fair unbiased picture should be drawn outlining positive and negative findings.

The findings should be classified according to their urgency. For example:

- Category 1 could be life threatening and must be corrected immediately e.g. uncontrolled emissions of hazardous waste or threats to the well-being of employees;
- Category 2 could be of high risk requiring a response prior to report publication;
- Category 3 could be of lower risk such as waste water with a high fat and grease content requiring more investigation;
- Category 4 is of much lower risk.

Furthermore, an overall picture of the facility should be drawn depicting the total inputs and outputs that go into the process. The following table is an example of the inputs and outputs of a leather manufacturing facility per production unit.

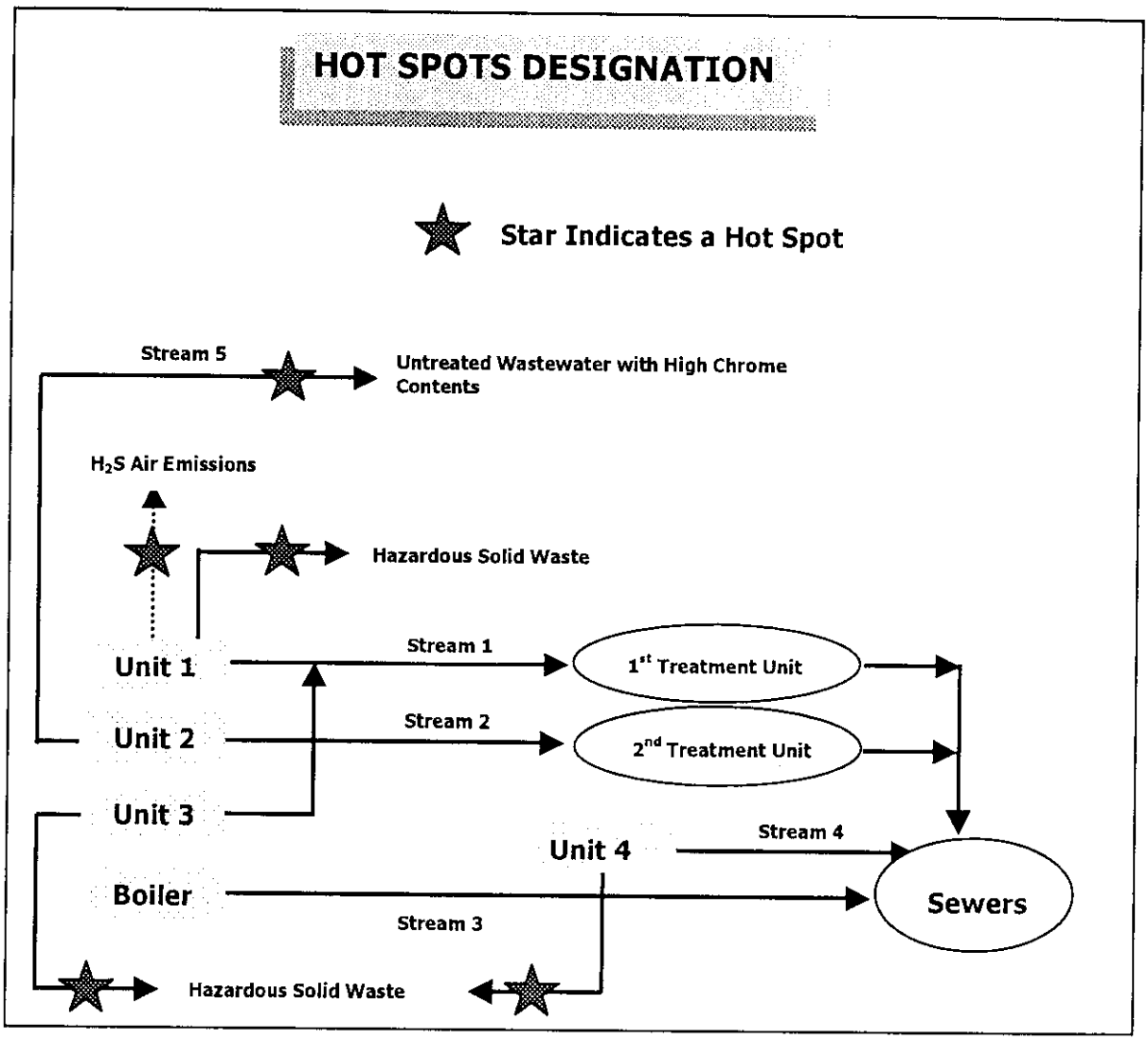
Optimisation[5] of Data for a Leather Manufacturing Facility

Input per Sq. Ft. of Product Generated.

Input		**Output**	
Raw Material		*Product*	
Salted Hides	5kg		1 Sq. Ft. of Leather
Chemicals		*Wastewater*	
Sodium Sulphide	80 g	Ammonia	14.59 g
Lime	151 g	Nitrates	21.61 g
Sodium Meta-Bisulphide	32 g	Phosphates	0.54 g
Ammonium Chloride	112 g	Sulphates	41.75 g
Soap	9 g	Chlorides	409.25 g
Pancreatic Enzyme	11 g	BOD_5	111.17 g
Formic Acid	36 g	COD	546.56 g
Sulphuric Acid	38 g	Sulphides	26.37 g
Sodium Formate	58 g	Chrome	0.36 g
Bicarbonates	5 g	*Solid Waste*	
Chrome	127 g	Hazardous Waste	2.0 kg
Organic Sulpho-acid	30 g	By-products	0.5 kg
Acrylic Resin	122 g	*Air Emissions*	
Sulphoacid Phenol	122 g	CO	9 ppm
Fat liquor	10 g	CO_2	2.8 %
Water		SO	43 ppm
	80 litres	SO_2	42 ppm
Energy		NO	0 ppm
	1000 kWh	NO_2	0 ppm
		NO_3	42 ppm

[5] The following figures are fictional and do not represent actual data.

Finally, an overall process flowchart should be drawn highlighting high risk areas or findings that are life threatening (categories 1 and 2) in every facility. These will be known as hot spots. The following table depicts a process flow chart. The stars indicate the hot spots that require immediate mitigation.



Determining the location of polluting hot spots at the facility could facilitate future compliance verification. In addition, the identification of compliance trends as well as the correct mitigation measures would be conducted more accurately and more easily.

The overall environmental load of pollutants generated from the facility should be documented. This could be achieved, for example, by taking into consideration the volume of wastewater generated per day by the facility. For example, if a facility is producing 50g of substance X per litre of wastewater and the environmental standard for that substance X is 60g/l, then as a first impression, this facility is abiding by the environmental standard set for it. However, if that facility is disposing 1,000 litres of wastewater per day then the actual amount of substance X discharged is = 50g/l x 1,000 l=50,000 g of substance X eventually implicating a heavy environmental load.

TIPS

When writing an audit report, avoid:

- **Using names of individuals;**
- **Using excess jargon, abbreviations, or acronyms.**

a2. Style

The audit report should be clear, concise and objective. The information obtained should be accurate.

a3. Finalisation of the audit report

The draft report should be given to the plant manager for review. The review will acquaint the manager with the findings and mitigation measures and help attain management support in their implementation.
Once the review has been done, the final draft is written taking into consideration management comments. The report should be accompanied by an action plan, which will be discussed in the following section.

b. Action Plan

The action plan addresses deficiencies, hot spots and priorities identified in the audit report. It sets targets, mitigation measures, a time frame and the expenditure needed. The plan should incorporate a compliance strategy, areas to be investigated further, blueprints for future environmental auditing programmes, blueprints for environmental awareness and training, a monitoring programme, relevant indicators and a time frame for implementation.

It is necessary to convince the management and staff that the recommended changes make sense and improve efficiency

b1. Compliance strategy

This part addresses life threatening and high-risk findings identified in the audit report. It states the tasks that should be taken to mitigate these problems and set deadlines for their completion. The strategy should develop a mechanism for regular reporting of the progress made to the management. The compliance strategy should state costs of measures and persons responsible for its implementation.

b2. Areas for further investigation

These deal with categories 3 and 4 identified in the audit report. They should be ranked according to their priority and environmental management targets should then be identified. The audit, for example, may identify regular equipment failure as a priority. This may call for an action plan that entails the establishment of a company-wide preventive maintenance programme.

b3. Blueprints for environmental auditing programmes

The original audit can be a baseline for future internal audits. A system should be established for the regular maintenance and updating of the baseline data collected during the initial audit such as material balances, emission inventories, waste stream analyses, etc. The original audit can also be the start off point for the development or review of the company's environmental management system and the up-dating of the company's environmental policy.

b4. Blueprints for an environmental awareness and training programme

This programme will help motivate the plant employees. The employees should be aware of their individual responsibilities to comply with national environmental regulations. This programme may consist of public relations actions such as workshops, posters or manuals. The findings of the management diagnostics mentioned in the audit report should be addressed in the training programme.

b5. Indicators

A set of verifiable indicators should be identified and used when necessary in subsequent internal audits at the facility. Such indicators used for future monitoring purposes would allow the better identification of the facility's overall environmental performances and progress. Furthermore, by monitoring the trends and success levels of the mitigation measures, corrective actions could be adopted accordingly.

b6. Blueprints for a progress monitoring programme

A programme should be established to measure improvements achieved in implementing the recommendations of the audit report and action plan. This will help in the identification of any arising problems and ensure that problems found in the audit are properly addressed. The improvements should be presented to the facility's personnel to show the benefits of the action plan and to increase staff motivation.

b7. Time frame for implementation

The action plan should be accompanied with a time-table. As it may take time for the staff to adapt to the new changes, it is advisable to implement the action plan gradually.

PRE-AUDIT QUESTIONNAIRE

GENERAL INFORMATION

Audit Site	
Pre-Audit Date	
Auditor(s)	
Site Personnel Responsible	

NOTES

ADDRESS & CONTACT

1. **Name of facility** _____

Type of facility _____

Location _____

Name of owner _____

Telephone _____

Fax _____

E-mail _____

2. **Please provide any additional information concerning the key personnel in the table below**

Key Personnel	
Name	**Position / Telephone**

FACILITY & PREMISES

3. Classification of visited industry 1 ☐ 2 ☐ 3 ☐

4. Is the facility located in an industrial zone? Yes ☐ No ☐

5. Is the facility located in a tourist area? Yes ☐ No ☐

6. Is the facility located in an agricultural zone? Yes ☐ No ☐

7. Is the facility located in a residential area? Yes ☐ No ☐

8. Is the facility located in a non-classified zone? Yes ☐ No ☐

Other, specify

_____

_____

9. Distance from the main road (m) _____

10. Distance from residential area (m) _____

11. Presence of nearby water bodies Yes ☐ No ☐

If yes, specify

_____

_____

12. Distance from surface water bodies (m) _____

13. Total area of premises (m^2) _____

14. **Number of floors** _____

15. **In the table below, please provide information about floor division and utilisation**

Floor Description			
Floor	**Area**	**Function**	**Remarks**

16. **Is there a car park?** **Yes** ☐ **No** ☐

Area of car park (m^2) _____

17. **Is there a nearby green area?** **Yes** ☐ **No** ☐

Type of green area _____

Area of green space (m^2) _____

Other, specify

_____

_____

18. **Are there any contaminated areas on the site?** **Yes** ☐ **No** ☐

If yes, please specify the type of contaminated site, its location and if any rehabilitation measures are planned

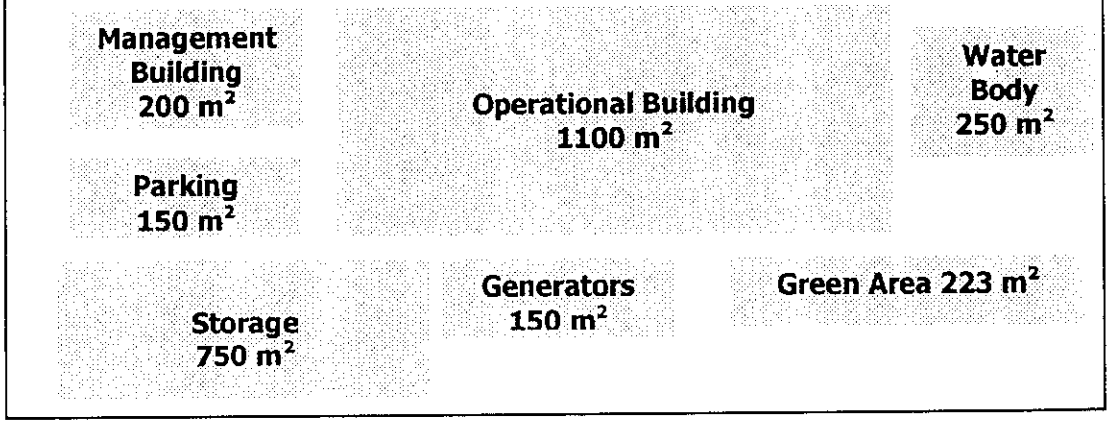
_____

_____

19. **In the space below, please draw a sketch of the layout of the premises**

LAYOUT OF PREMISES

EXAMPLE OF LAYOUT SKETCH



EMPLOYEES AND SHIFTS

20. **Total number of employees** _____

21. **Total number of full time employees** _____

22. **Total number of part time employees** _____

23. **Number of managerial employees** _____

24. **Number of production employees** _____

25. **Number of production hours per day** _____

26. **Number of shifts per day** _____

27. **Number of production days per week** _____

28. **Number of operational days per year** _____

LEGAL STATUS

29. **Does the facility have a working permit?** **Yes** ☐ **No** ☐

If yes, when was it issued (date)? _____

Where was it issued? _____

30. **Is the permit temporary?** **Yes** ☐ **No** ☐

If yes, specify the expiry date _____

31. **Are the premises owned or rented?** _____

32. **Date the facility was rented/acquired?** _____

ENVIRONMENTAL MANAGEMENT

33. **Do you have an environmental unit or department in charge of environmental issues?** **Yes** ☐ **No** ☐

34. **Do you have an environmental coordinator?** **Yes** ☐ **No** ☐

If applicable, please provide details about the environmental coordinator

Name _____

Title _____

Telephone _____

35. **Please describe the environmental coordinator or unit's responsibilities below**

_____

_____

_____

_____

_____

_____

_____

36. **Do you have maintenance schemes? Are they documented in writing?** **Yes** ☐ **No** ☐

If yes,

In which departments are they applied?

_____

_____

How often are the maintenance schemes conducted?

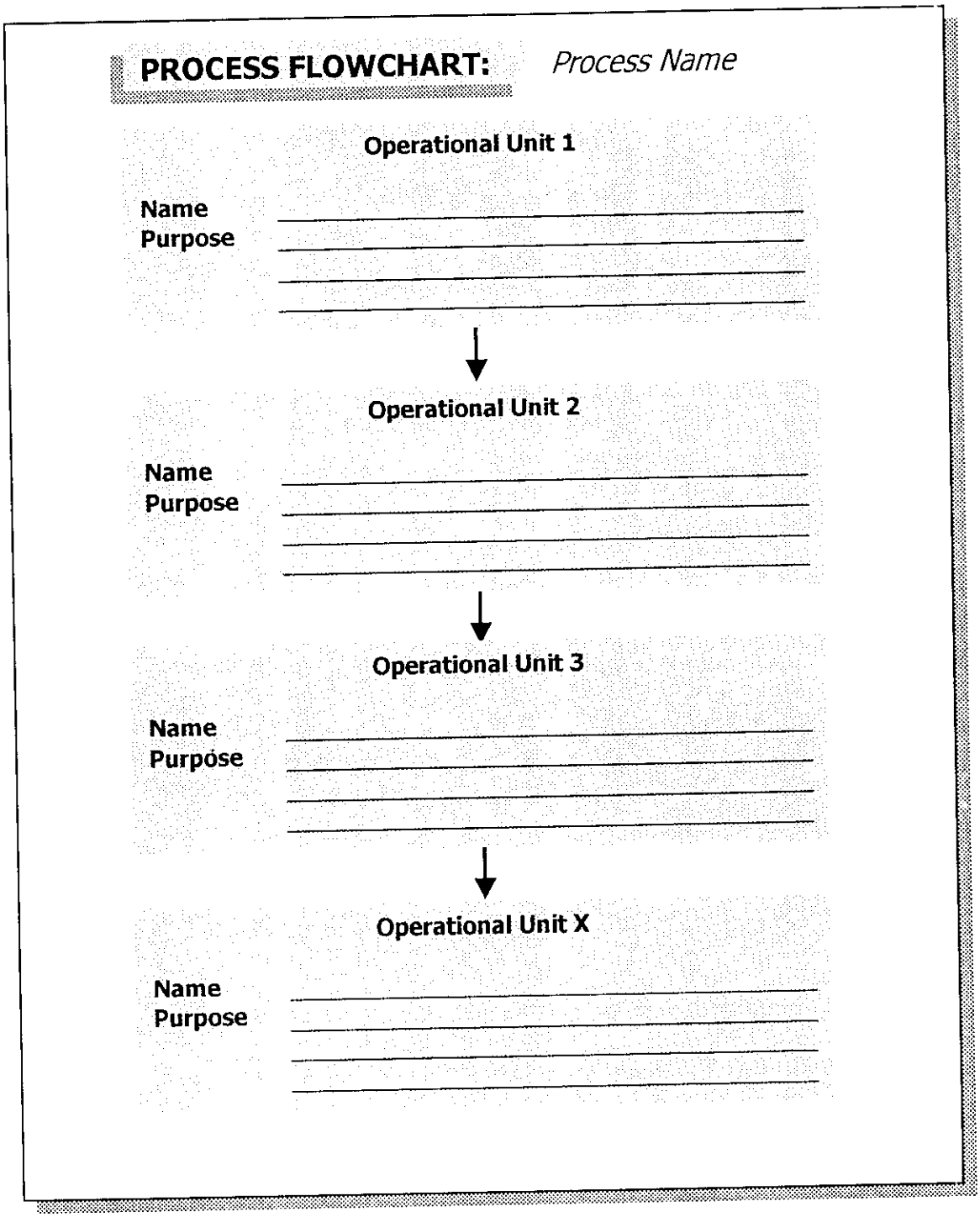
_____

_____

37. Where do you see a need for action in the organisation of the company's environmental protection?

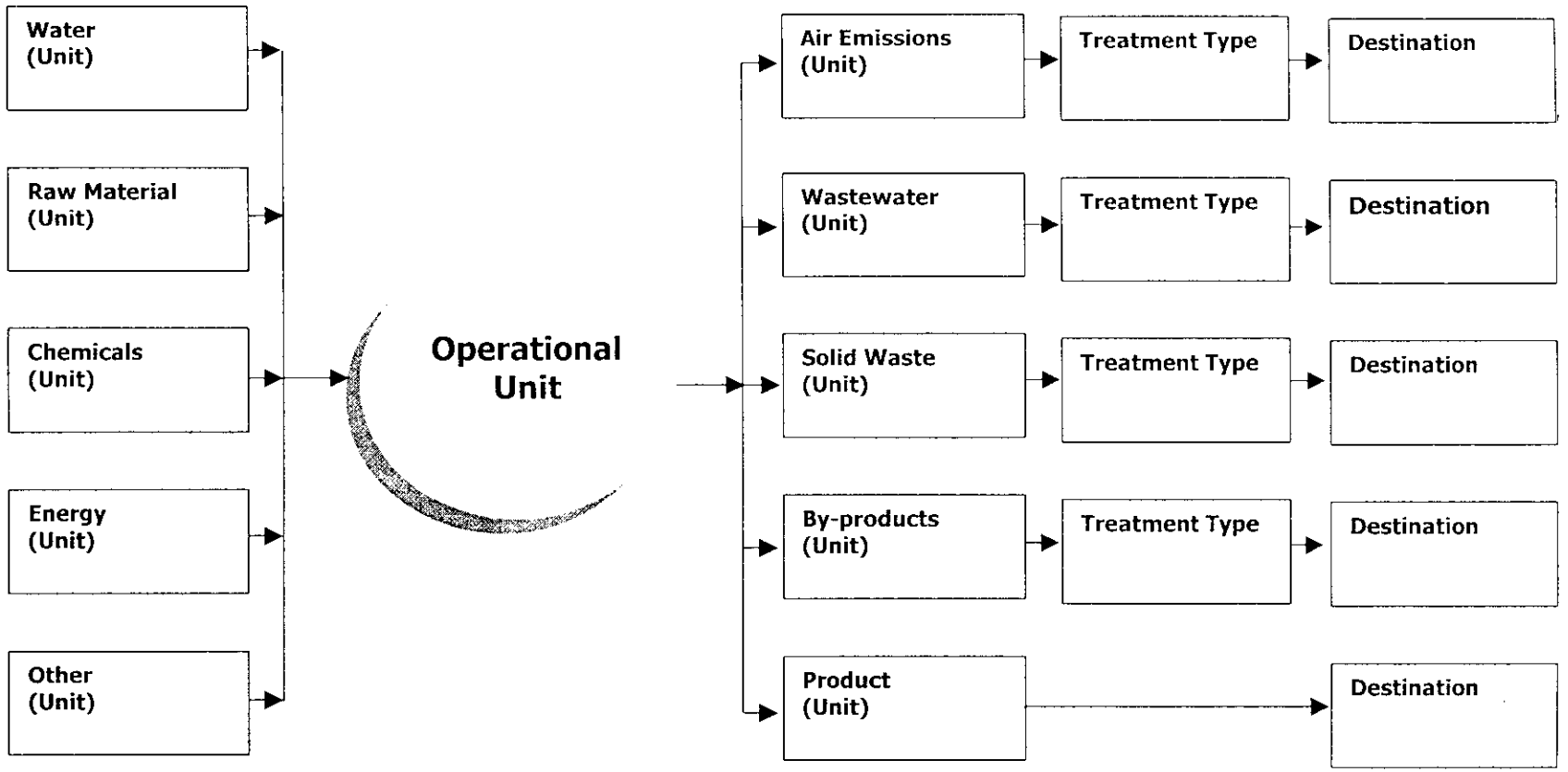
PROCESS DESCRIPTION

38. **In the flowcharts below, please provide a brief description of the purpose of every operational unit in the overall production process**



INPUT AND OUTPUT PER OPERATIONAL UNIT

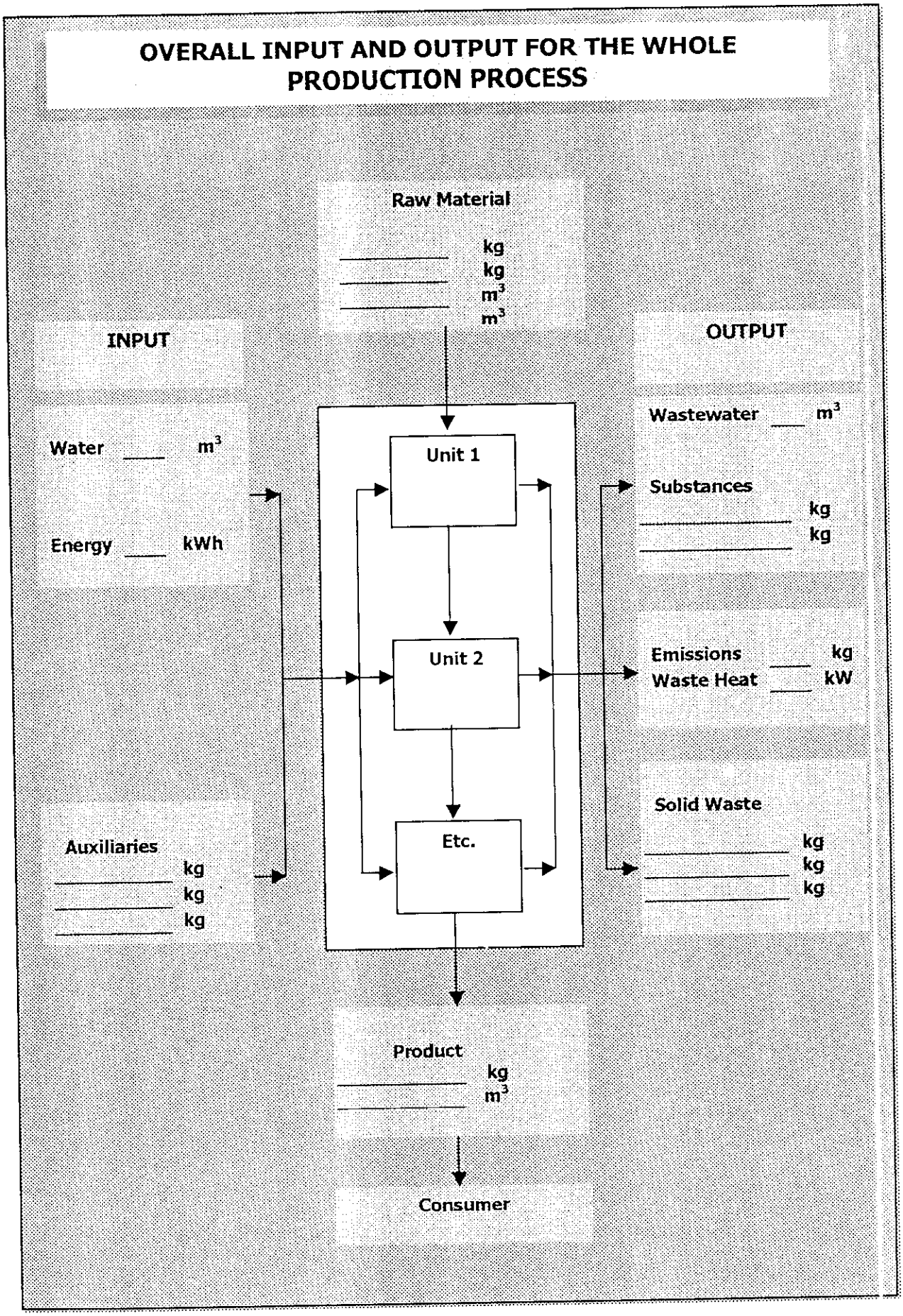
Repeat for Every Operational Unit



INPUT

Describe condition and average age of operational utilities.

OUTPUT


OVERALL INPUT AND OUTPUT FOR THE WHOLE PRODUCTION PROCESS
Raw Material
kg
kg
m3
m3
INPUT
OUTPUT
Water m3
Energy kWh
Unit 1
Unit 2
Etc.
Wastewater m3
Substances
kg
kg
Emissions kg
Waste Heat kW
Solid Waste
kg
kg
kg
Auxiliaries
kg
kg
kg
Product
kg
m3
Consumer

ENERGY CONSUMPTION

39. Average yearly consumption of electricity (kWh/year)

40. Specify the source(s) of electricity (government, generator, etc.)

41. Specify the different types of fuel[1] used (heavy fuel, natural gas, etc.)

42. Specify the average yearly consumption of each fuel type

Average Fuel Consumption		
Fuel Type	**Average Yearly Consumption**	**Total Costs US$/Year**

43. Other energies used, specify

[1] Do not include the fuel used for transportation purposes.

44. Have any energy saving measures been implemented?

AIR EMISSIONS

45. **Is there an air pollution monitoring programme?** **Yes** ☐ **No** ☐

If yes, please describe the programme and its results

_____

_____

46. **Are there any controls to reduce emissions to air?** **Yes** ☐ **No** ☐

If yes, describe

_____

_____

WATER CONSUMPTION

47. Amount of municipal water consumed (m^3/year) _____

48. Amount of surface water taken (m^3/year) _____

49. Surface water location _____

50. Amount of well water consumed (m^3/year) _____

51. Water well location _____

52. Method of extraction of well water

_____

_____

53. Is water treated before use? Yes ☐ No ☐

If yes, describe

_____

_____

54. Other sources, specify

_____

_____

_____

_____

_____

55. Have any water saving measures been installed?

_____

_____

_____

_____

_____

WASTEWATER GENERATION

56. Is wastewater treated before discharge Yes ☐ No ☐

If yes, describe

_____

_____

57. Is there a wastewater quality monitoring programme? Yes ☐ No ☐

If yes, describe

_____

_____

58. Process wastewater generated (m^3/year) _____

59. Type of receiving system of discharge

Sewer ☐

Soil ☐

Ground water ☐

Surface water ☐

Evaporation pond ☐

Other, specify

_____

_____

60. Sanitary wastewater generated (m^3/year) _____

61. Type of receiving system of discharge

Sewer	☐
Soil	☐
Ground water	☐
Surface water	☐
Evaporation pond	☐
Trucked off	☐

Other, specify

_____

_____

SOLID AND/OR HAZARDOUS WASTE GENERATION

62. **Please complete the table below**

Solid Waste Generation					
Type of Waste	**Source of Generation**	**Quantity (Kg or Liters/day)**	**Storage Location**	**Modes of Transport to Storage**	**Final Destination**
Hazardous Solid Waste					
Hazardous Liquid Waste					
Non-hazardous Solid Waste					
Packaging					
Other					

PRODUCTS AND RAW MATERIAL

63. **Please enter the required information into the table below**

Raw Material Consumption	
Type of Raw Material	**Quantity Used in Tonnes/Year**

64. **Is there an inventory for all raw material purchased?** **Yes** ☐ **No** ☐

Type of inventory registration method **FIFO**[2] ☐ **LIFO**[3] ☐

Other, specify

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

[2] FIFO: First In First Out.
[3] LIFO: Last In First Out.

65. **Please enter the average yearly production over the past 5 years into the table below**

Average Yearly Production	
Year	**Average Number of Products Manufactured**

66. **Is there an inventory for all products manufactured?** **Yes** ☐ **No** ☐

Type of inventory registration method **FIFO**[4] ☐ **LIFO**[5] ☐

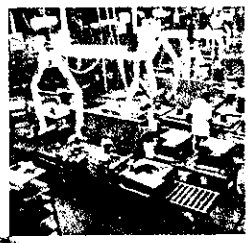
Other, specify

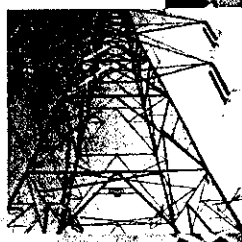
_____

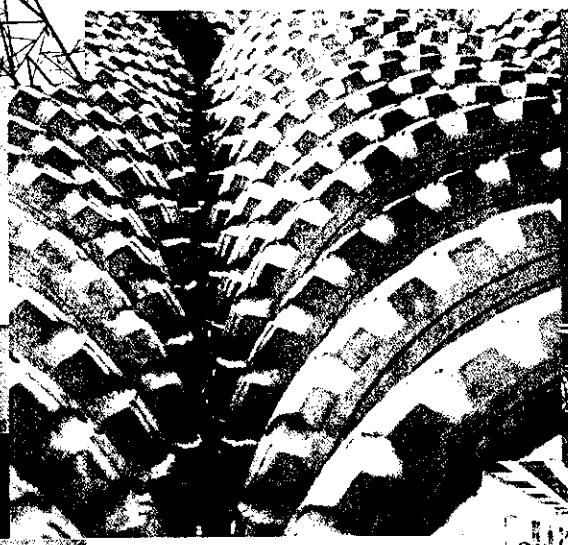
_____

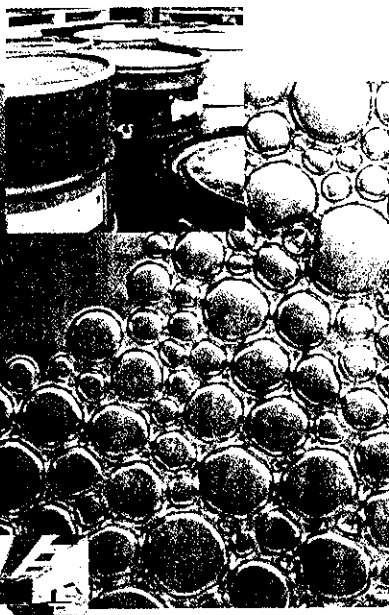
[4] FIFO: First In First Out.
[5] LIFO: Last In First Out.

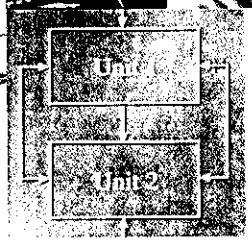
ANNEX II
Full Audit Checklists

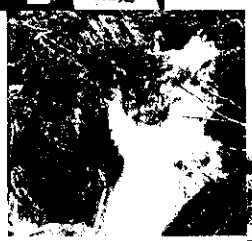


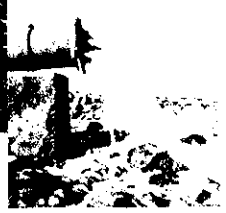


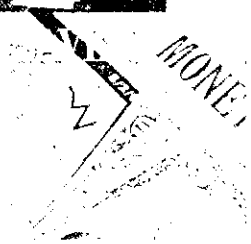




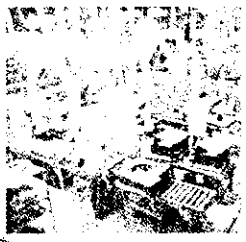


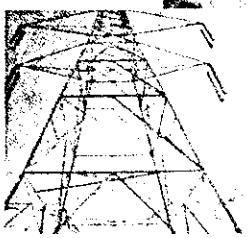


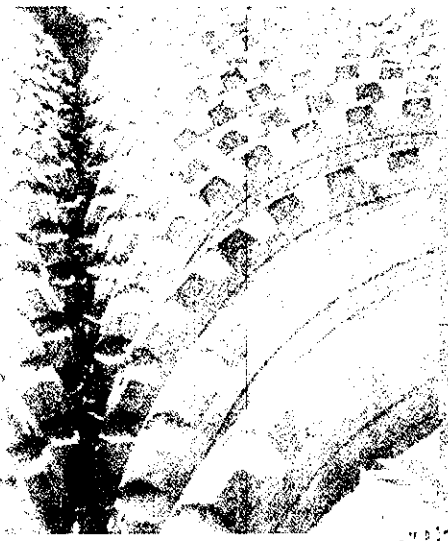




ANNEX II: Full Audit Checklists







AUDIT CHECKLIST: Environmental Management

AUDIT CHECKLIST: Environmental Management

GENERAL INFORMATION

Audit Site	
Audit Date	
Auditor(s)	
Site Personnel Responsible	

NOTES

GENERAL

If information is already available from the pre-audit questionnaire, skip to question #4.

1. **Do you have an environmental unit or department responsible for environmental issues?** **Yes** ☐ **No** ☐

2. **Do you have an environmental coordinator?** **Yes** ☐ **No** ☐

3. **If applicable, write down the name of the environmental coordinator**

   Name _____

   Title _____

   Telephone _____

4. **Describe below the responsibilities of the environmental coordinator or unit**

   _____

   _____

   _____

   _____

   _____

   _____

   _____

   _____

   _____

   _____

   _____

   _____

   _____

   _____

5. **Is management aware of any environmental regulations relating to their facility?** **Yes** ☐ **No** ☐

If yes, specify below the type of regulations and related standards

Wastewater regulations

_____

_____

Air emissions standards

_____

_____

Solid waste disposal

_____

_____

Other, specify

_____

_____

_____

_____

_____

6. **Is the facility applying any type of environmental programme?** **Yes** ☐ **No** ☐

If yes, is this environmental programme efficiently applied. Describe how?

_____

_____

7. **Is the programme based on international standards (i.e. ISO 14000, EMAS, etc.) or on internal initiatives (i.e. good housekeeping, etc.), describe?**

_____

_____

8. **Does the facility have any environmental certification (i.e. ISO 14000, EMAS, etc.)?** **Yes** ☐ **No** ☐

If yes, specify type, date of acquisition, and the reasons behind acquiring it

MONITORING ACTIVITIES

9. **Are there any environmental control programmes?** **Yes** ☐ **No** ☐

If yes, describe the types of monitoring programmes

Monitoring Programmes Implemented	
Type of Monitoring Programme	**Describe below the purpose of each programme implemented (financial savings, health and safety issues, etc.) and its level of success.**
Monitoring energy consumption	
Monitoring water consumption	
Monitoring wastewater generation	
Monitoring raw material consumption	
Monitoring solid waste generation	
Monitoring air emissions	
Other	

10. **Are measurement values recorded and stored?** **Yes** ☐ **No** ☐

INVENTORY MANAGEMENT

11. **What type of system do you apply for your inventory management?**

LIFO[1] ☐ **FIFO**[2] ☐ **Other** ☐

If other, please explain below the type of inventory monitoring programme (timing , frequency, etc.)

12. **Are you facing any space limitations?** **Yes** ☐ **No** ☐

If yes, please describe actions undertaken to deal with such issues

[1] LIFO: Last In First Out.
[2] FIFO: First In First Out.

HAZARDOUS MATERIAL MANAGEMENT

13. **Are there any management practices for handling hazardous waste (i.e. treatment, special disposal, etc.)?**

14. **Are there any special storage measures, handling procedures for hazardous material?** **Yes** ☐ **No** ☐

If yes, describe

15. **Is there any generation of hazardous waste?** **Yes** ☐ **No** ☐

If yes, describe in the table below the hazardous waste generation

Hazardous Waste Generation		
Types of Waste	**Quantities Generated (tonnes/year)**	**Destination**

AWARENESS

16. **Are there any steps carried out to increase employees' environmental awareness?** Yes ☐ No ☐

If yes, what are the initiatives conducted relative to increasing the overall environmental awareness of employees (training sessions, financial incentives, workshops, production of awareness material, etc.)?

CHALLENGES

17. **Has the facility faced any environmental problems or complaints?** **Yes** ☐ **No** ☐

If yes, what type of complaints?

Local:

_____

_____

_____

_____

_____

International (export):

_____

_____

_____

_____

_____

Describe the initiatives carried out to deal with such issues

_____

_____

_____

_____

_____

_____

_____

_____

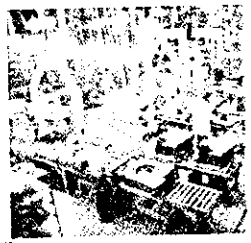
_____

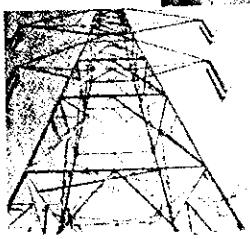
_____

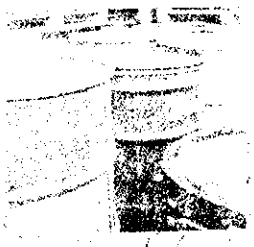
FUTURE PLANS

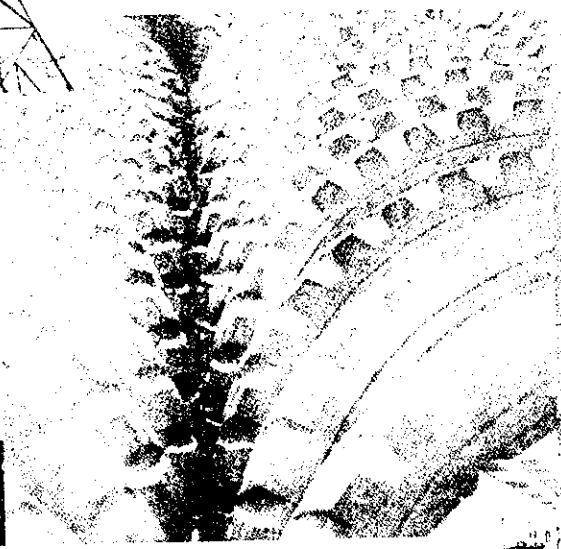
18. **Is the facility planning to obtain any environmental certification in the future (i.e. ISO, etc.)?** **Yes** ☐ **No** ☐

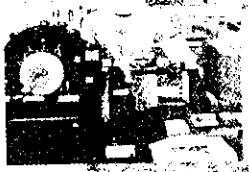
19. **Describe any future plans relative to environmental issues**

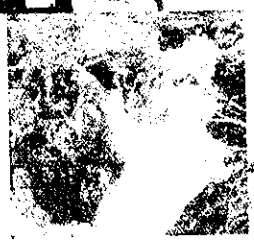












AUDIT CHECKLIST: Production Process

AUDIT CHECKLIST: Production Process

GENERAL INFORMATION

Audit Site	
Audit Date	
Auditor(s)	
Site Personnel Responsible	

NOTES

GENERAL

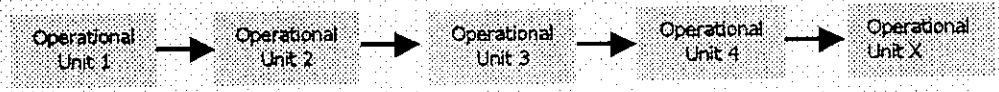
The following general checklist is to be filled in for every operational unit of the process. Thus, for each specific step, a checklist has to be completed with all necessary information, to be used later in conducting the final material balance calculations.
Water, wastewater, solid waste or air emissions originating from sources other than the production process are also to be considered as unit operations and similar checklists are to be completed.

1. **Name of process operational unit**

_____

2. **Number/Position in overall process chart, if applicable**

_____



3. **Purpose of operational unit**

_____

_____

4. **Detailed description of operational unit (include a general summary of the way this unit process is conducted, duration, etc.)**

_____

_____

_____

_____

_____

_____

_____

_____

5. **Type of operational unit**

Continuous ☐ **Batch** ☐

Other, specify

_____

_____

6. **If batch process, what is the operational time needed to conduct it?**

_____

INPUTS

7. List in the table below the different kinds of chemicals and raw material used per operational unit process

Raw Material and Chemicals				
Name	**Scientific Name (if Any)**	**Actual[3] Quantity (Unit)**	**Theoretical Quantity (Unit)**	**% Difference Actual Vs Theoretical**
Raw Material				
Chemicals				
Other				

8. Describe the way raw materials are weighed

[3] The actual quantities correspond to the quantity measured during the audit by the audit team members, while the theoretical quantities correspond to the values given by the plant manager.

9. **List in the table below information concerning water consumption**

Water Consumption			
Source	**Actual Quantity (Litres, m^3)**	**Theoretical Quantity (Litres, m^3)**	**% Diff. (Actual Vs Theoretical)**

10. **Is the process water treated prior to use?** **Yes** ☐ **No** ☐

If yes, what is the method of treatment?

_____

_____

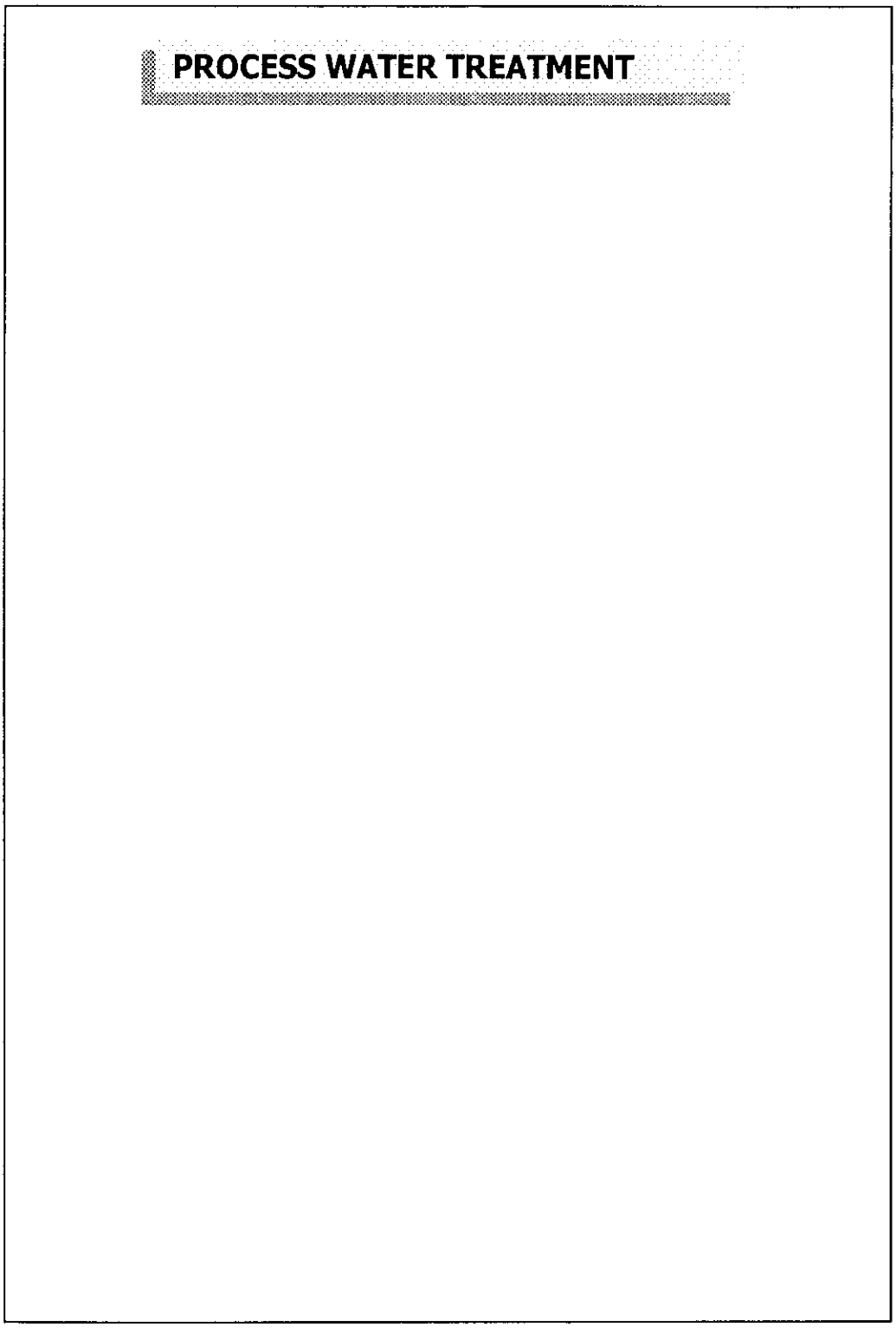
11. **In the table below, provide the characteristics of input water**

Water Analysis					
Sample Number	**pH**	**Temperature**	**Hardness[4]**	**Ca^{2+}**	**Other[5]**

[4] Give results as equivalent concentration in mmol(eq)/l.

[5] If the source is well water and if the facility is close to the coastal area, check for salt concentration.

12. **Provide a flowchart description of the process water treatment**



13. **In the table below, provide information about energy consumption**

Energy		
Type	**Source**	**Average Consumption (Unit)**
Electricity		
Heat		
Steam		
Other		

OUTPUTS

14. **Fill in the following table with data on wastewater**

Wastewater		
Quantity Generated (Units)	**Final Destination**	**Type of Treatment Conducted, if Any**

15. **In the table below, provide characterisation of output wastewater**

Effluent Discharge Monitoring Data[6]				
Parameter Analysed in Effluent	**Result Obtained**	**Sample Procedure**	**Frequency of Collection**	**Date & Time**

[6] The sampling table found in Annex III "Sampling Checklist" provides a list of the main wastewater samples to be taken according to the industry being audited.

16. **Fill in the following solid waste table**

Solid Waste Generation & Treatment					
Type	**Source**	**Quantity Generated (Unit)**	**Type of Treatment Conducted, if Any**	**Final Destination**	**Ways of Transportation to Final Destination**

17. **List in the table below the air pollutants emitted from this operational unit[7]**

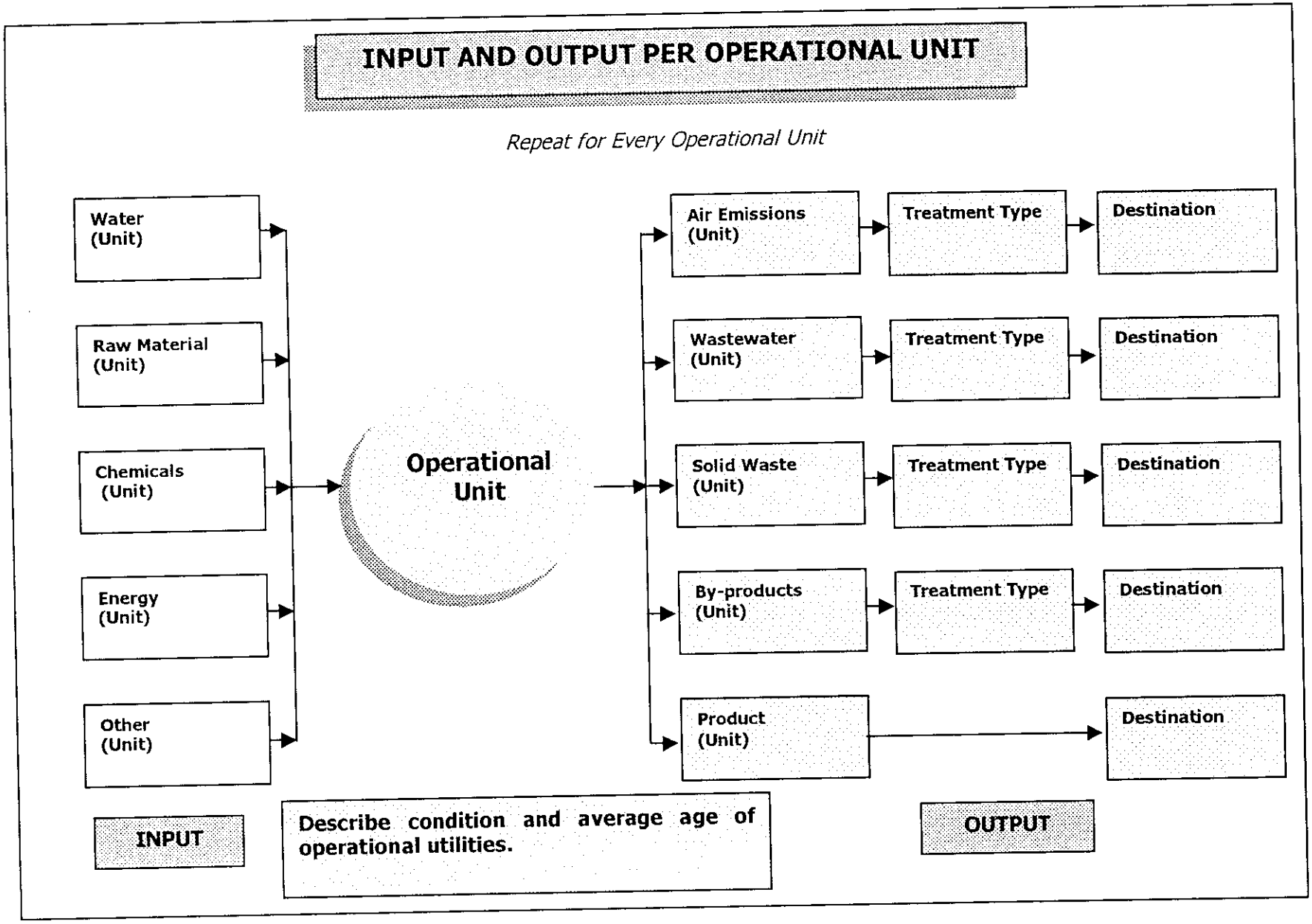
Air Pollutants[8] Characterisation						
Type	**Concentration (ppm)**	**Flow Rate of Gaseous Emissions (m^3/h)**	**Method of Measurement**	**Specify Treatment, if Conducted**	**Destination (i.e. Stack, etc.)**	**Observation (i.e. Hazardous, Dangerous, etc.)**
VOCs						
H_2S						
Odours						
Other						

[7] Please duplicate this sheet for each operational unit.
[8] The sampling table found in Annex III provides a list of the main air pollutants to be sampled according to the audited industry.

18. **In the table below, provide information about product and by-product generation**

Products Manufactured and By-product Generation			
Product	**Quantity (Unit)**	**Destination**	**Ways of Transportation**
By-products	**Quantity (Unit)**	**Destination**	**Ways of Transportation**

19. **Operational unit flowchart to be repeated for every operational unit**



MISCELLANEOUS

20. **Have any raw materials been recovered and reused?** **Yes** ☐ **No** ☐

If yes, give details

_____

_____

_____

_____

_____

21. **Additional observations**

_____

_____

_____

_____

_____

_____

_____

_____

CLEANING PROCEDURES

22. **Are there any cleaning procedures conducted at the end of the operational unit?** **Yes** ☐ **No** ☐

23. **Provide the frequency and a detailed description of the cleaning procedures conducted as well as the quantities of raw material used for such operations**

_____

_____

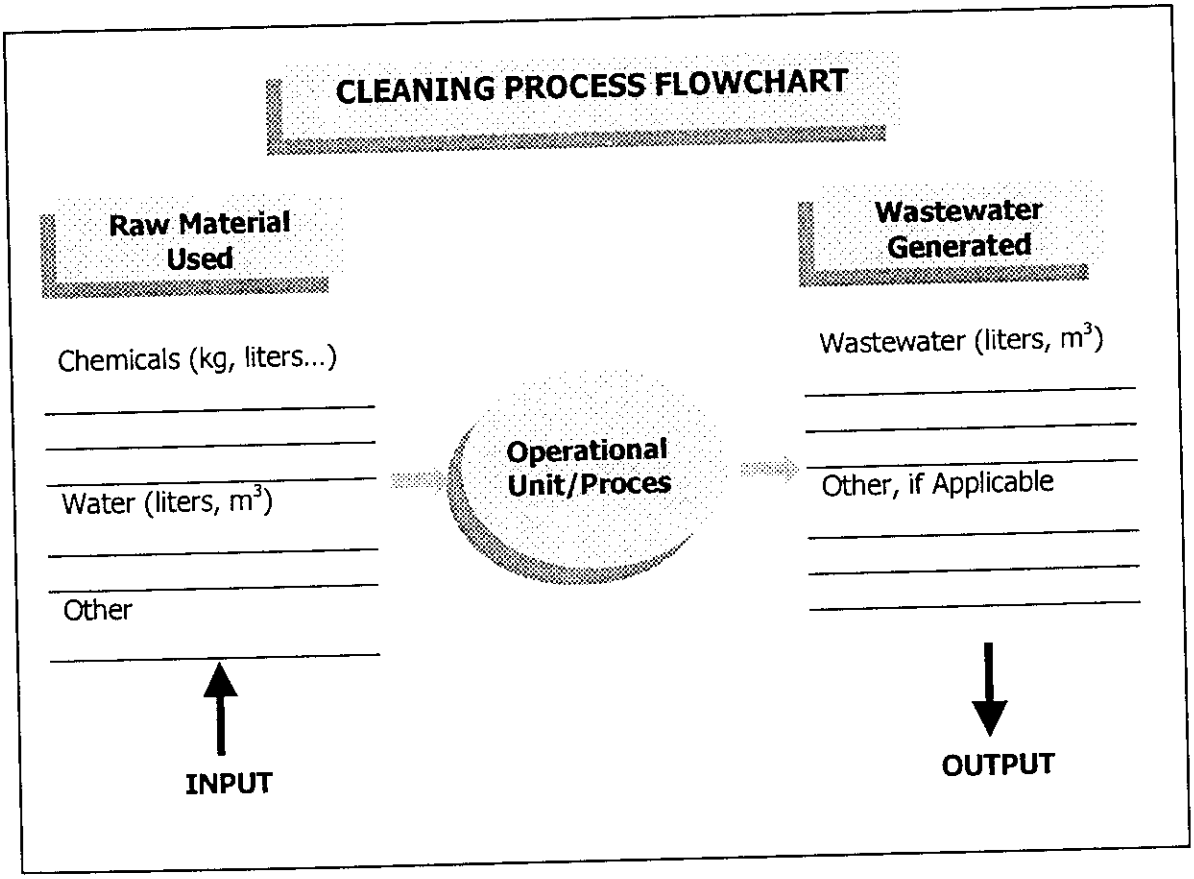
_____

_____

_____

_____

CLEANING PROCESS FLOWCHART



24. Using the overall information gathered and the charts above as visual aids, conduct a material balance for each operational unit[9]

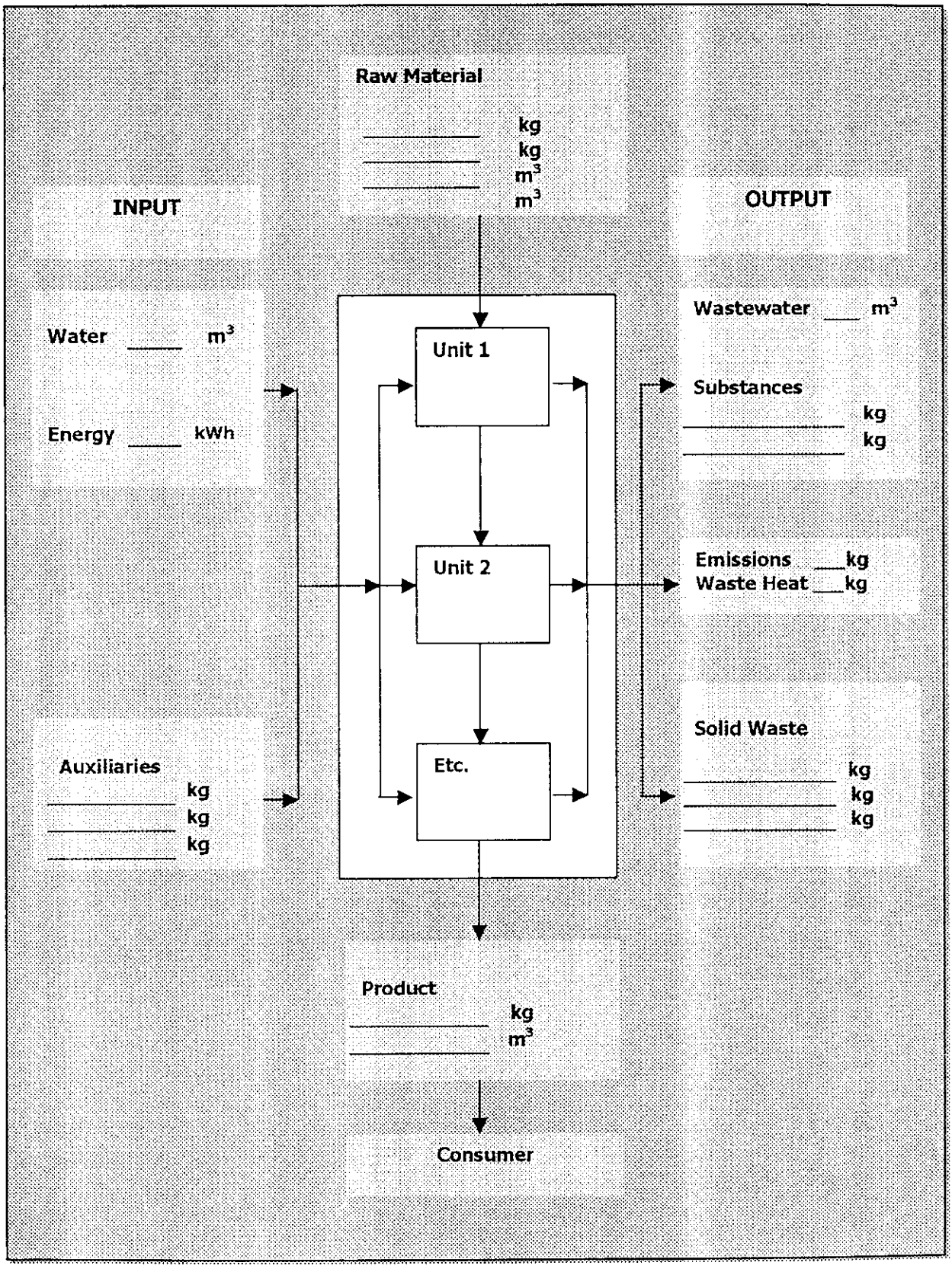
Material Balance Table							
Unit Number	**Water In**	**Wastewater Quantities Out**	**Raw Material Quantities In**	**Solid Waste / Product / By-products Out**	**Hazardous Material Out**	**Energy In**	**Air Emissions Out**
Unit 1							
Unit 2							
Unit 3							
Etc.							
Total							

[9] This category covers all raw material, chemicals, catalysts, etc.

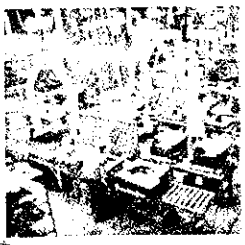
Combine the results of all operational units and optimise energy consumption, water, chemicals and raw material usage, wastewater and solid waste generation, by-product generation, air emissions, etc. per unit of product manufactured (please refer to the example in Chapter 2).

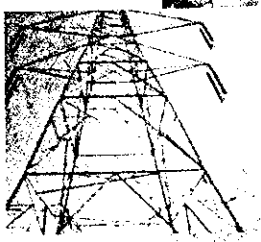
OVERALL PROCESS FLOWCHART

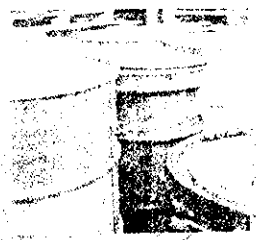
25. **Using the figure below draw the overall production flowchart by linking all units together and calculate overall material balance**

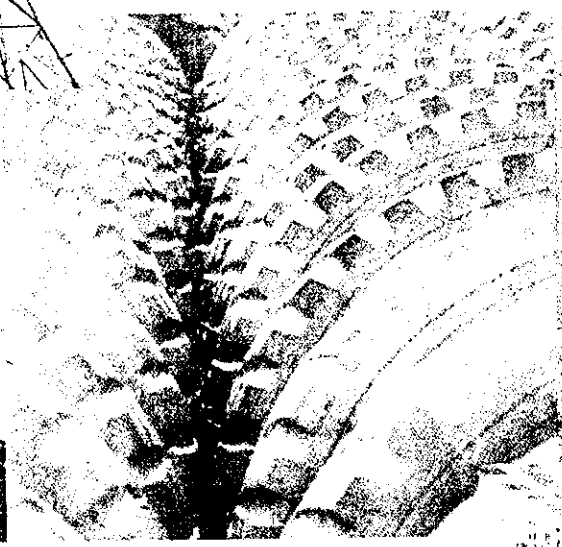


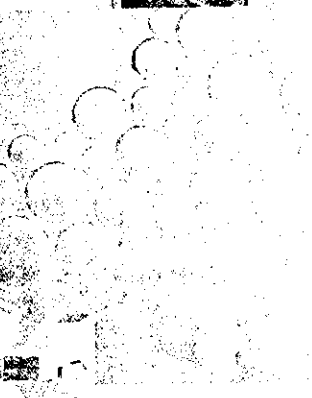
ANNEX II:
Full Audit
Checklists

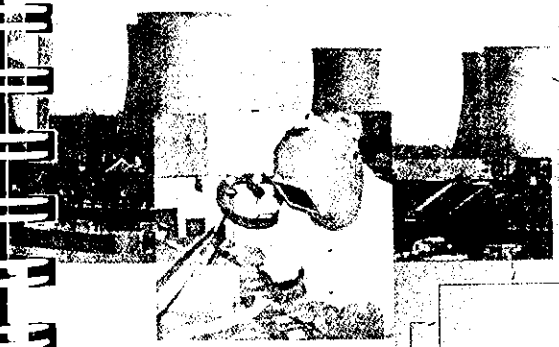


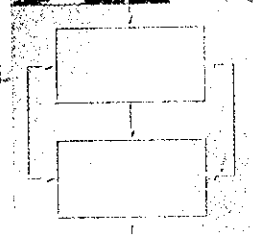












AUDIT CHECKLIST:
Water Supply

AUDIT CHECKLIST: Water Supply

GENERAL INFORMATION

Audit Site	
Audit Date	
Auditor(s)	
Site Personnel Responsible	

NOTES

WATER

1. What is the total amount of water consumed per year (m^3/yr)? _____

2. What is the total amount of surface water consumed (m^3/yr)? _____

3. What is the total amount of ground water consumed (m^3/yr)? _____

4. What is the total amount of municipal water consumed (m^3/yr)? _____

Other, specify

_____

_____

DRINKING WATER

5. Source of drinking water — Consumption m^3/year

Well water	☐	_____
Bottled water	☐	_____
Municipal water	☐	_____
Surface water	☐	_____

Other, specify

_____

_____

6. Total drinking water consumption m^3/year _____

7. **Is the drinking water treated?** **Yes** ☐ **No** ☐

If yes,

Is the drinking water treated at the facility prior to use?

_____

_____

What is the method of treatment?

_____

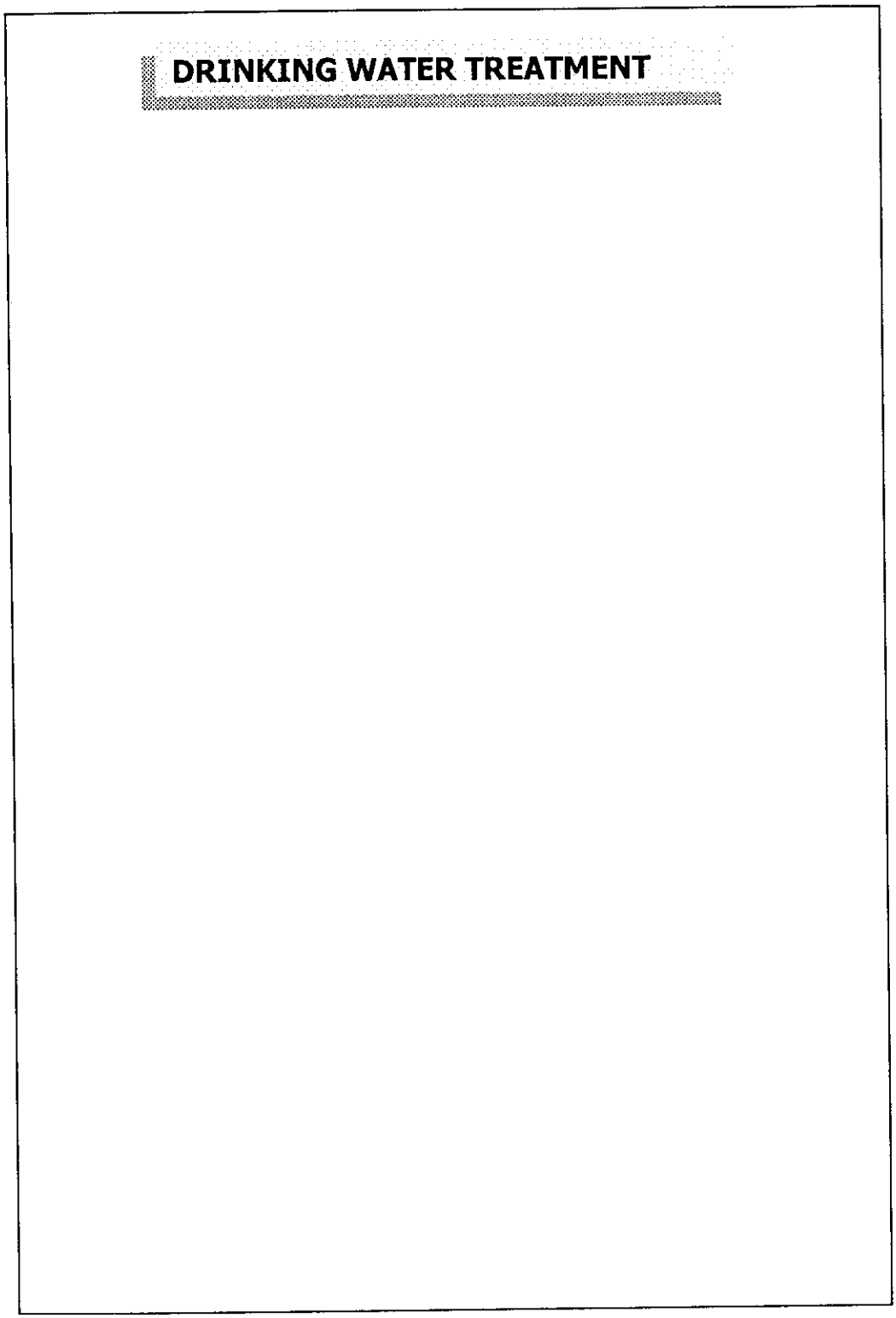
_____

_____

_____

_____

8. **In the space below, provide a flowchart of the drinking water treatment**



9. **In the table below, characterise the quality of drinking water**

Drinking Water Analysis[10]					
Sample Number	**pH**	**Temperature**	**Hardness[11]**	**Ca^{2+}**	**E.coli / Total Coliforms**

10. **Is drinking water examined regularly?** **Yes** ☐ **No** ☐

If yes,

What is the water sampling procedure practice?

_____

_____

What is the frequency of examination?

_____

_____

[10] By comparing input water analysis vs. output water analysis, one can assess the quality of treatment practiced.

[11] Give results as equivalent concentration in mmol(eq)/l.

SHOWER WATER

11. **Source of shower water** — **Consumption m^3/year**

Well water ☐ _____

Municipal water ☐ _____

Surface water ☐ _____

Other, specify

_____

_____

12. **Total shower water consumption m^3/year** _____

13. **Is the shower water treated?** **Yes** ☐ **No** ☐

If yes,

Is the shower water treated at the facility prior to use?

_____

_____

What is the method of treatment?

_____

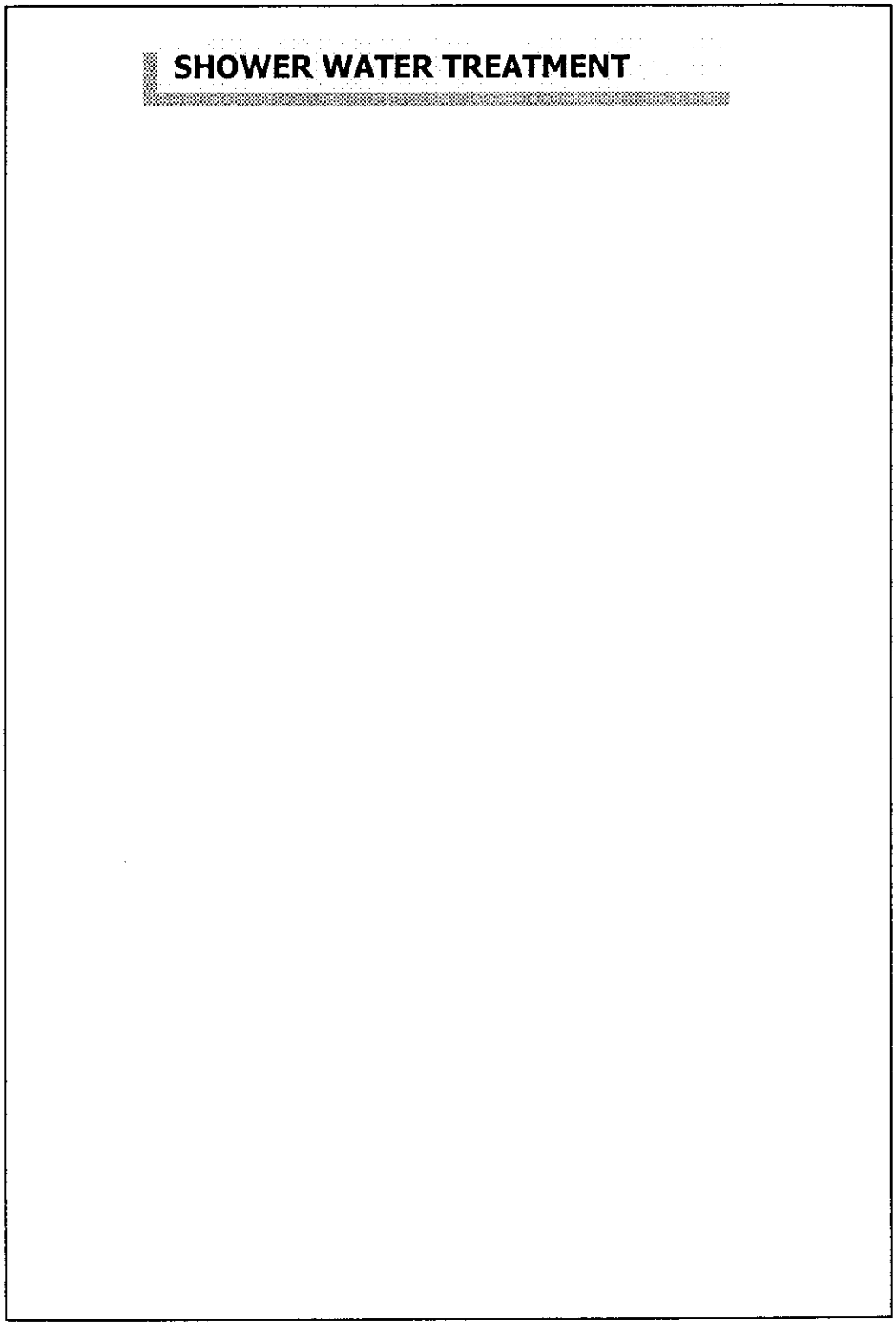
_____

_____

_____

_____

14. **In the space below, provide a flowchart of the shower water treatment**



15. **In the table below, characterise the quality of the shower water**

Shower Water Analysis					
Sample Number	**pH**	**Temperature**	**Hardness[12]**	**Ca^{2+}**	**Total Coliforms**

16. **Is shower water examined regularly?** **Yes** ☐ **No** ☐

If yes,

What is the water sampling procedure?

_____

_____

What is the frequency of examination?

_____

_____

[12] Give results as equivalent concentration in mmol(eq)/l.

PROCESS WATER

Please refer to the process checklist to fill in the information on water used in the production process.

UTILITY WATER

17. **Source of boiler water** — **Consumption m^3/year**

Well water ☐ _____

Municipal water ☐ _____

Surface water ☐ _____

Other, specify

_____

_____

18. **Total boiler water consumption m^3/year** _____

19. **Is the boiler water treated?** **Yes** ☐ **No** ☐

If yes,

Is the boiler water treated at the facility prior to use?

_____

_____

What is the method of treatment?

_____

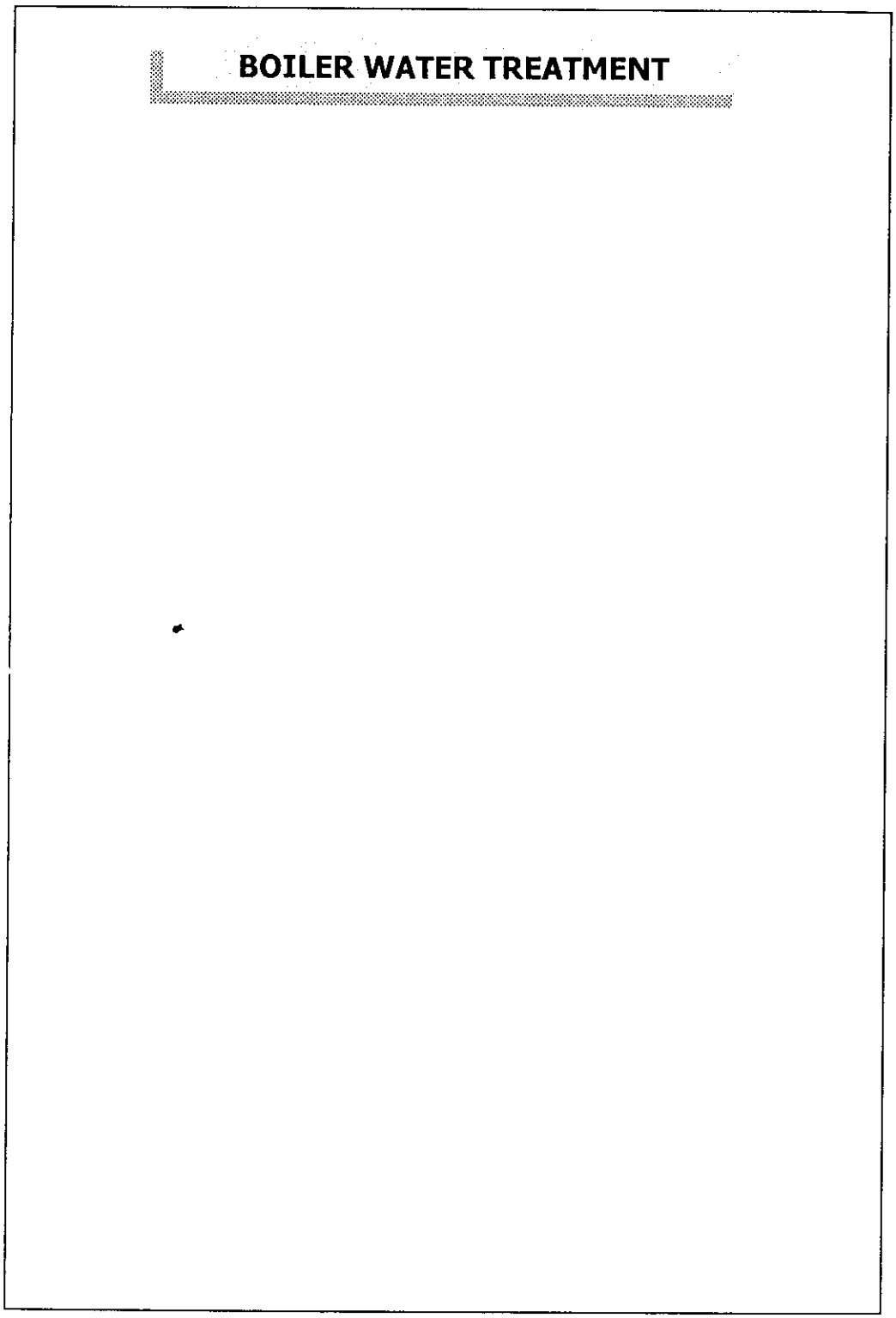
_____

_____

_____

_____

20. **In the space below, provide a flowchart of the boiler water treatment**



21. **In the table below, characterise the quality of the boiler water**

Boiler Water Analysis					
Sample Number	**pH**	**Temperature**	**Hardness[13]**	**Ca^{2+}**	**Other**

22. **Is boiler water examined regularly?** **Yes** ☐ **No** ☐

If yes,

What is the water sampling procedure?

_____

_____

What is the frequency of examination?

_____

_____

[13] Give results as equivalent concentration in mmol(eq)/l.

23. **Source of cooling tower water** — **Consumption m^3/year**

Well water ☐ _____

Municipal water ☐ _____

Surface water ☐ _____

Other, specify

_____

_____

24. **Total cooling tower water consumption m^3/year** _____

25. **Is the cooling tower utility water treated?** **Yes** ☐ **No** ☐

If yes,

Is the cooling tower's water treated at the facility prior to use?

_____

_____

What is the method of treatment?

_____

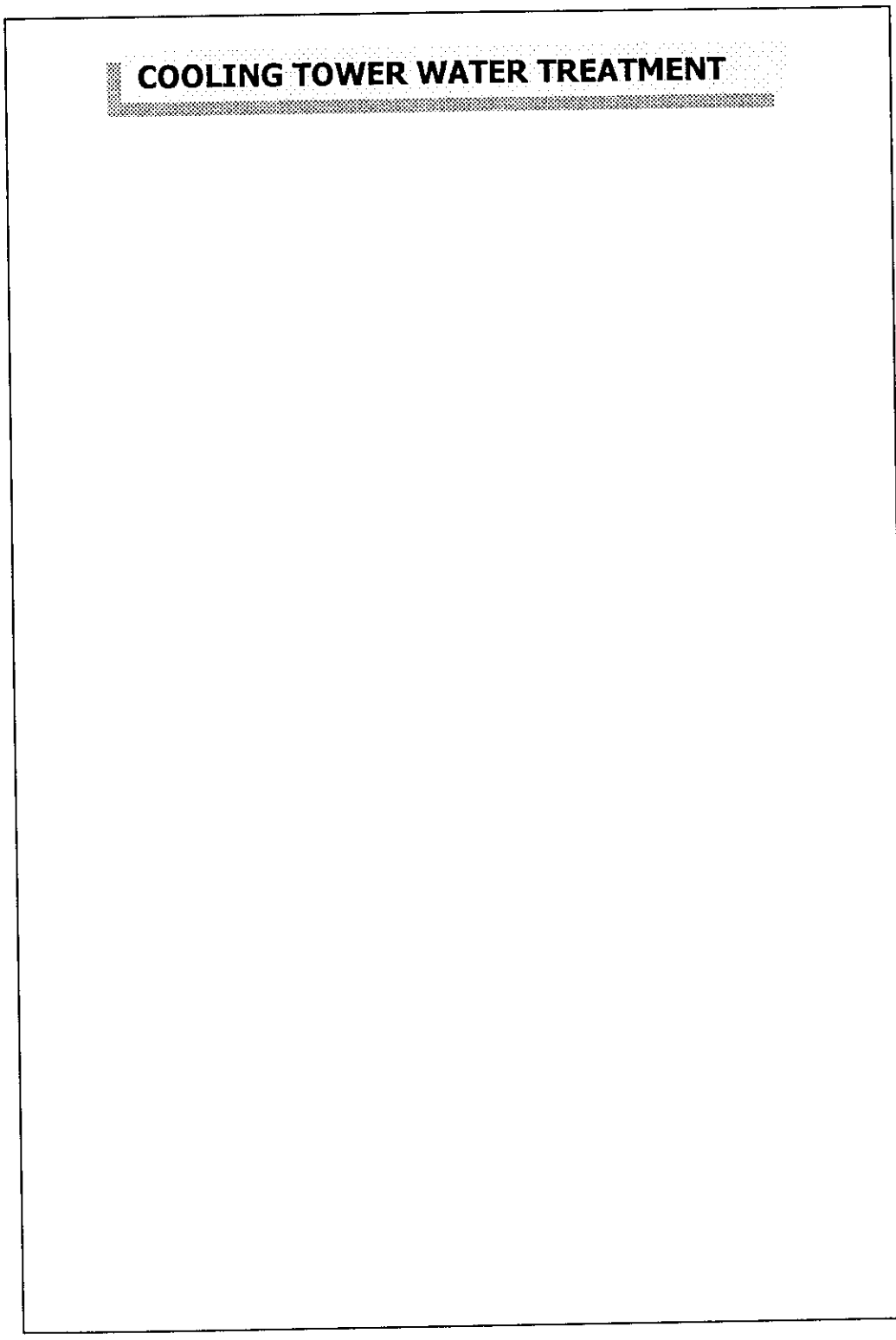
_____

_____

_____

_____

26. **In the space below, provide a flowchart of the cooling tower water treatment**



27. **In the table below, characterise the quality of the cooling tower water**

Cooling Tower Water Analysis					
Sample Number	**pH**	**Temperature**	**Hardness[14]**	**Ca^{2+}**	**Other**

28. **Is the cooling tower water examined regularly?** **Yes** ☐ **No** ☐

If yes,

What is the water sampling procedure?

_____

_____

What is the frequency of examination?

_____

_____

[14] Give results as equivalent concentration in mmol(eq)/l.

EYEWASH WATER

29. **Source of eyewash water** — **Consumption m^3/year**

Well water ☐ _____

Municipal water ☐ _____

Surface water ☐ _____

Other, specify

_____

_____

30. **Total eyewash water consumption m^3/year** _____

31. **Is this water treated** **Yes** ☐ **No** ☐

If yes,

Is the eyewash water treated at the facility prior to use?

_____

_____

What is the method of treatment?

_____

_____

_____

_____

_____

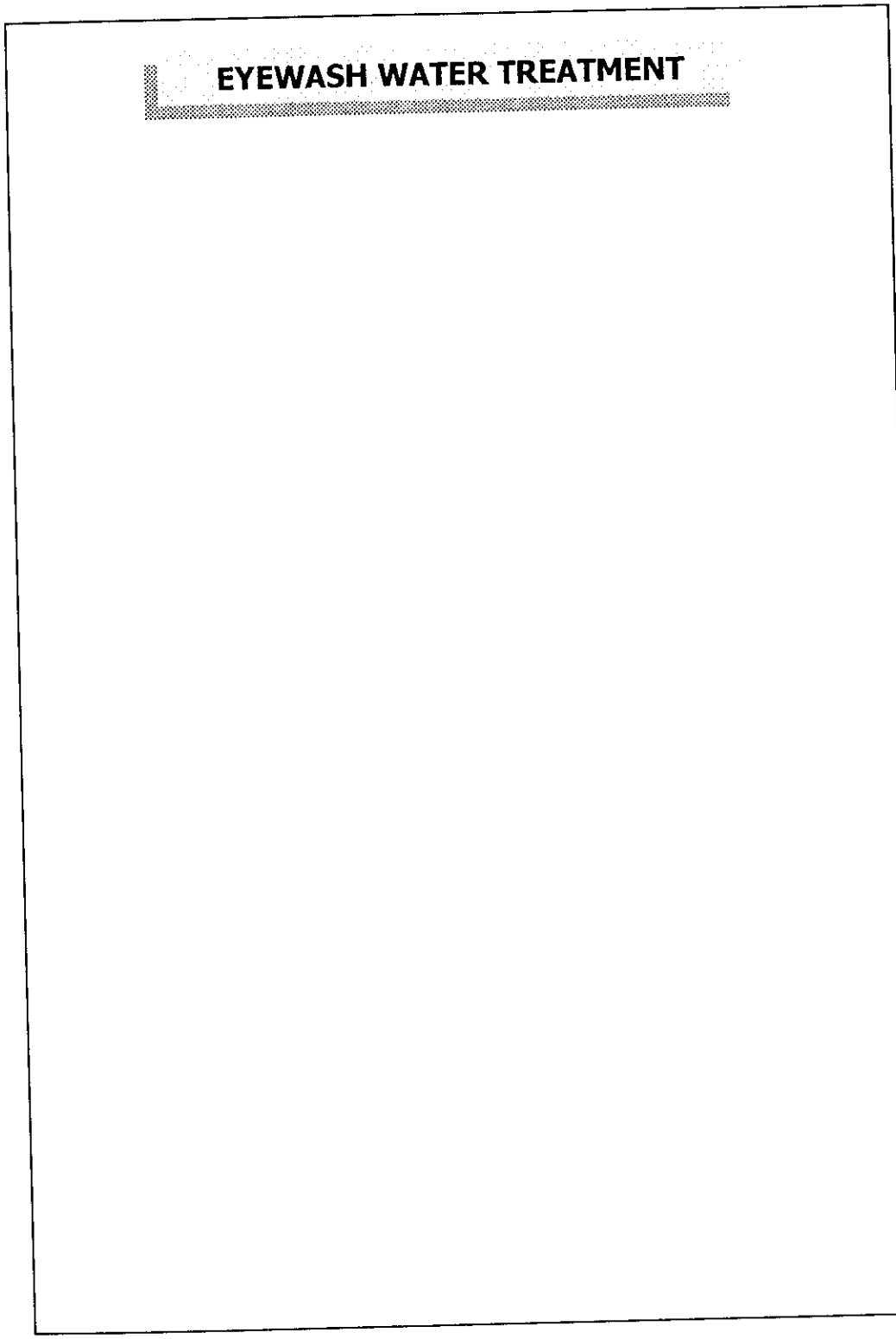
32. **Is eyewash water quality controlled?** **Yes** ☐ **No** ☐

- **If yes,**

How often is it controlled? _____

What is the method of control? _____

33. **In the space below, provide a flowchart of the eyewash water treatment**



34. **In the table below, characterise the quality of eyewash water**

Eyewash Water Analysis				
Sample Number	pH	Temperature	Total Coliforms/ 100 ml	Other

35. **Is eyewash water examined regularly?** Yes ☐ No ☐

If yes,

What is the water sampling procedure?

_____

_____

What is the frequency of examination?

_____

_____

WATER MISCELLANEOUS

36. **Is water used for other purposes?** **Yes** ☐ **No** ☐

If yes, specify below for which purposes

_____

_____

37. **Source of "miscellaneous" water** **Consumption m^3/year**

Well water ☐ _____

Bottled water ☐ _____

Municipal water ☐ _____

Surface water ☐ _____

Other, specify

_____

_____

38. **Total "miscellaneous" water consumption m^3/year** _____

39. **Is other remaining water treated?** **Yes** ☐ **No** ☐

If yes,

Is the other remaining water treated at the facility prior to use?

_____

_____

What is the method of treatment?

_____

_____

_____

_____

_____

40. **In the space below, provide a flowchart of any other water treatment**

MISCELLANEOUS WATER TREATMENT

41. **In the table below, characterise the quality of "miscellaneous" water**

Miscellaneous Water Analysis					
Sample Number	pH	Temperature	Hardness[15]	Ca^{2+}	Other

42. **Is "miscellaneous" water examined?** **Yes** ☐ **No** ☐

If yes,

What is the water sampling procedure?

_____

_____

What is the frequency of examination?

_____

_____

[15] Give results as equivalent concentration in mmol(eq)/l.

MISCELLANEOUS

43. Does the facility have a supply well? Yes ☐ No ☐

If yes,

Does it have a permit for it? Yes ☐ No ☐

When does the permit expire (date)? _____

What is the amount of water allocated to be extracted daily (m^3/day)? _____

44. Does the facility have a surface water supply source? Yes ☐ No ☐

If yes,

What is this source? _____

Does it have an extraction permit for it? Yes ☐ No ☐

When does the permit expire (date)? _____

What is the amount of water allocated to be extracted daily (m^3/day)? _____

45. Does the plant have water storage tanks or vessels? Yes ☐ No ☐

If yes, describe monitoring programmes conducted (tank leakages, quality, etc.)

_____

_____

46. **In the table below, describe the tanks' volume, age and condition**

Water Tank Characteristics				
Tank Number	**Designated Use**	**Volume**	**Age**	**Condition**

47. **Describe the overall condition of the water network in the facility**

Any damaged pipes? **Yes** ☐ **No** ☐

Any leakages? **Yes** ☐ **No** ☐

Estimated water loss (m^3/year or %) _____

Other, specify

_____

_____

_____

_____

_____

_____

_____

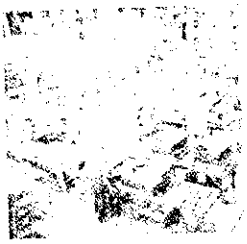
_____

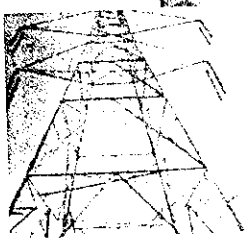
_____

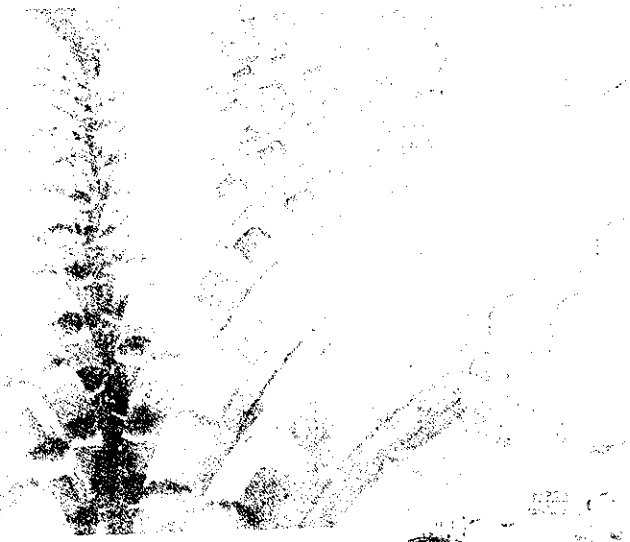
_____

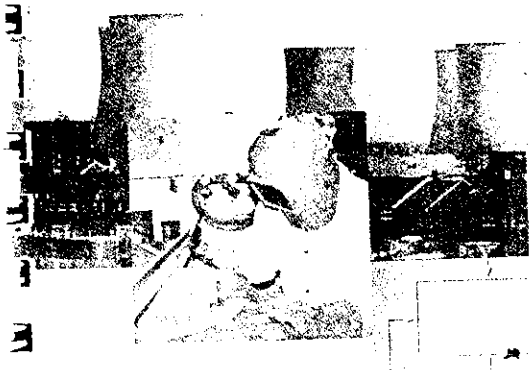
48. **Which measures for optimised water use are available?**

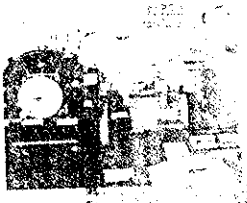
Water recycling	**Yes**	☐	**No**	☐
Closed water circuits	**Yes**	☐	**No**	☐
Water and / or wastewater balance	**Yes**	☐	**No**	☐
Wastewater register	**Yes**	☐	**No**	☐
Separation of drinking water and process water	**Yes**	☐	**No**	☐
Wastewater treatment according to the state of the art	**Yes**	☐	**No**	☐
Use of flow or pressure reducers and stop-cocks at respective sites	**Yes**	☐	**No**	☐











AUDIT CHECKLIST:
Wastewater Management

AUDIT CHECKLIST: Wastewater Management

GENERAL INFORMATION

Audit Site	
Audit Date	
Auditor(s)	
Site Personnel Responsible	

NOTES

For wastewater generated from the production process, please refer to the process checklist.

FACILITY EFFLUENT DISCHARGE POINTS

1. **Specify the final discharge location of the wastewater generated**

Surface water bodies ☐

Municipal sewage system ☐

Evaporation pond or seepage pond ☐

Groundwater ☐

Septic system ☐

Injection wells ☐

Draining ditches ☐

Other, specify

_____

_____

2. **Describe the difficulties encountered while discharging the wastewater, if any**

_____

_____

_____

_____

_____

_____

_____

_____

_____

WASTEWATER SOURCES

3. **Specify the different sources of wastewater generated by the facility**

Process	☐
Boilers	☐
Cooling tower	☐
Contaminated storm water effluent	☐
Non-contaminated storm water effluent	☐
Condensate	☐
Loading/unloading station run-off	☐
Barometric condensers	☐

Other, specify

_____

_____

TREATMENT MEASURES

4. **Is wastewater treated?** Yes ☐ No ☐

If yes, is it treated on-site or off-site or both? _____

5. **Specify the wastewater treatment practised as well as its source**

Treatment type		Source of wastewater
Organic or oil separation	☐	_____
Settling	☐	_____
Aeration	☐	_____
Filtration	☐	_____
Neutralisation	☐	_____
Activated carbon	☐	_____
Evaporation	☐	_____
Chemical treatment	☐	_____
Bacterial treatment	☐	_____
None	☐	

Other, specify

_____

_____

6. Fill in the following "Wastewater Generation & Destination" table

Wastewater Generation And Destination(s)				
Effluent Sources	**Quantity (Unit)**	**Wastewater Receivers**	**Treatment Methods**	**Final Destination[16]**
Boiler Blow Down	*75 m^3/day*	*Septic Tank*	*Sedimentation*	*Sewers*
Operational Unit 1	*200 m^3/day*	*Stream 1*	*Filtration & Oxidisation*	*Sewers*

[16] Refers to the final destination after treatment.

7. **Fill in the following table for wastewater characteristics**

Effluent Characteristics[17]					
Source	**Parameter Analysed in Effluent**	**Result Obtained**	**Sample Procedure**	**Frequency of Collection**	**Date & Time**
Stream1[18]	*pH*	*6-7-8*	*Snap Sample*	*2 Samples*	*3/5/2000, 12:00 p.m. 3/5/2000, 12:30 p.m.*
Stream 1	*Hardness*	*20 mg/litre*	*Snap Sample*	*1 Sample*	*22/9/2000, 12:00 p.m.*

[17] Other than wastewater generated from process.
[18] Has to be clearly specified in the operational unit process.

WASTEWATER DISCHARGES SUMMARY

8. **Provide below the necessary information about the wastewater**

Wastewater Types: Volumes & Sources				
Type	**Volume (m^3/day)**	**Source**	**Channel**	**Destination**
Total Process Wastewater	*250*	*Unit 1*	*Stream 2*	*Treatment Plant*

Is any wastewater reused/recycled? **Yes** ☐ **No** ☐

If yes, describe where it is used

_____

_____

9. **Describe the overall situation of the wastewater collectors in the facility**

Any damaged channels? **Yes** ☐ **No** ☐

Any leakages? **Yes** ☐ **No** ☐

Estimated wastewater loss (m^3/year or %) _____

Other, specify

_____

_____

_____

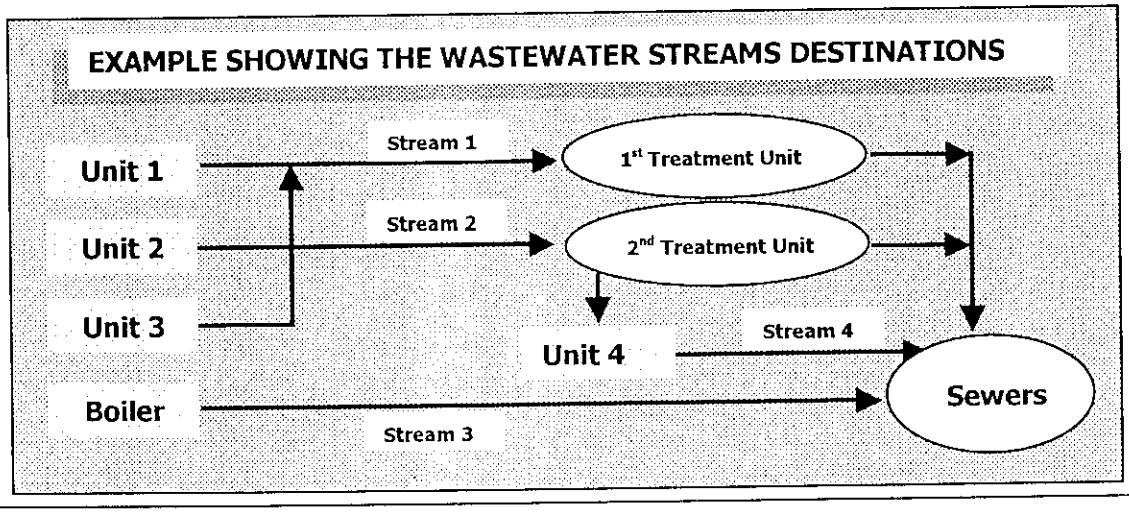
_____

_____

9. **In the space below, draw a flow chart representing all the sources of wastewater in the facility (i.e. operational unit, auxiliaries, etc.)**

WASTEWATER FLOWCHART

EXAMPLE SHOWING THE WASTEWATER STREAMS DESTINATIONS



LEGAL ISSUES

10. **Does your plant adhere to any wastewater discharge regulations?** Yes ☐ No ☐

If yes, what are those regulations?

_____

_____

11. **Do you have a permit for discharging?** Yes ☐ No ☐

If yes, when does it expire (date)? _____

12. **Has wastewater quality ever been monitored before[19]?** Yes ☐ No ☐

13. **Is there an agency that conducts routine wastewater inspections?** Yes ☐ No ☐

If yes, name that agency?

_____

_____

14. **How often does it conduct inspections?** _____

15. **If applicable, write down the date of the most recent inspection** _____

[19] If possible include a photocopy of results.

AUDIT CHECKLIST:
Air Emissions

AUDIT CHECKLIST: Air Emissions

GENERAL INFORMATION

Audit Site	
Audit Date	
Auditor(s)	
Site Personnel Responsible	

NOTES

For indoor air quality, please refer to the occupational health and safety checklist.

BOILER

1. **Does the plant operate a boiler[20]?** **Yes** ☐ **No** ☐

If yes,

Date of installation _____

Heat input Joule/hr _____

What type of fuel is burned? _____

Sulphur content of fuel burned _____

What is the yearly fuel consumption? _____

Average daily / yearly operational time _____

What is the destination of steam / hot water generated from the boiler? _____

Quantity of steam generated from the boiler _____

Source of make up water _____

Quality of make up water (softened or not) _____

Quantity of make up water _____

[20] If more than one boiler is operated, please repeat the same procedure for each one separately.

Frequency of blow down water _____

Quality of blow down water _____

Quantity of blow down water _____

Discharge location of blow down water _____

2. **Is there a regular maintenance programme for the boiler?** **Yes** ☐ **No** ☐

If yes, describe the methodology and the aims of the programmes

_____

_____

_____

_____

3. **Provide in the table below, the characteristics of the air emissions generated**

Pollutants Generated by the Boiler			
Pollutants	**Value at Start-up**	**Value at 30 Minutes**	**Value at 2 Hours**
CO_2			
CO			
NO			
NO_2			
NO_x[21]			
SO_2			
SO_3			
SO_x[22]			
Dust			
Other			

[21] If showing results in [mg/m³], calculate concentration as NO_2.
[22] If showing results in [mg/m³], calculate concentration as SO_2.

4. **What are the types of air pollution control equipment used to improve the boiler's stack emission quality?**

5. **Comments/Remarks**

GENERATOR

6. **Does the plant operate a generator[23]?** **Yes** ☐ **No** ☐

Date of installation _____

Total power generated (kVA) _____

Type of fuel consumed _____

Sulphur content of fuel consumed _____

Average monthly fuel consumption _____

7. **What is the average daily operation time?** _____

8. **Is there a regular maintenance programme for the generator?** **Yes** ☐ **No** ☐

If yes, describe the methodology and aims of the programmes

_____

_____

_____

_____

_____

9. **Has a noise reduction system been installed?** **Yes** ☐ **No** ☐

What type of system is it? _____

[23] If more than one generator is operated, please repeat the same procedure for each one separately.

10. **When and why is the generator operated?**

11. **Provide in the table below, the characteristics of the air emissions generated**

Pollutants Released by the Generator			
Pollutants	**Value at Start-up**	**Value at 30 Minutes**	**Value at 2 Hours**
CO_2			
CO			
NO			
NO_2			
NO_x[24]			
SO_2			
SO_3			
SO_x[25]			
Dust			
Other			

12. **What are the types of air pollution control equipment used to improve the generator's stack emission quality?**

[24] If showing results in [mg/m³], calculate concentration as NO_2.
[25] If showing results in [mg/m³], calculate concentration as SO_2.

13. Comments/Remarks

FURNACE

14. **Does the plant operate a furnace[26]?** Yes ☐ No ☐

If yes,

Does it consume >25L of conventional liquid fuel/hr? Yes ☐ No ☐

Does it consume >35kg of conventional solid fuel/hr? Yes ☐ No ☐

Does it consume >35 m^3 of natural gas/hr? Yes ☐ No ☐

Type of fuel consumed _____

Quantity of fuel consumed _____

Sulphur content of fuel consumed _____

Operation time in 24 hours _____

Details of automatic or semi-automatic control connected _____

Details of burner appliance in the case of liquid or gas fuel use _____

Is there dark smoke emission for more than 6 minutes in any period of 4 hours? _____

Is there dark smoke emission for more than 3 minutes continuously at any time? _____

[26] If more than one furnace is operated, please repeat the same procedure for each furnace separately.

15. **Is there a regular maintenance programme for the furnace?** **Yes** ☐ **No** ☐

If yes, describe the methodology and the aims of such programmes

_____

_____

_____

_____

_____

16. **Provide in the table below, the characteristics of the air emissions generated**

Pollutants Generated by the Furnace			
Pollutants	**Values at Start-up**	**Value at 30 Minutes**	**Value at 2 Hours**
CO_2			
CO			
NO			
NO_2			
NO_x[27]			
SO_2			
SO_3			
SO_x[28]			
Dust			
Other			

17. **What are the types of air pollution control equipment used to improve the furnace's stack emission quality?**

_____

_____

_____

_____

[27] If showing results in [mg/m^3], calculate concentration as NO_2.
[28] If showing results in [mg/m^3], calculate concentration as SO_2.

18. **Comments/Remarks**

INCINERATOR

19. **Does the plant operate an incinerator[29]?** Yes ☐ No ☐

If yes, what is the main function of the incinerator and what is it used for?

_____

_____

Does it consume >25L of conventional liquid fuel/hr? Yes ☐ No ☐

Does it consume >35kg of conventional solid fuel/hr? Yes ☐ No ☐

Does it consume >35 m^3 of natural gas/hr? Yes ☐ No ☐

Type of fuel consumed _____

Grade of fuel consumed _____

Sulphur content of fuel consumed? _____

Quantity of fuel consumed _____

Operation time in 24 hours _____

Details of the mechanical stoking device in the case of solid fuel use _____

Details of burner appliance in the case of liquid or gas fuel use _____

Is there dark smoke emission > than 6 minutes in any period of 4 hours? Yes ☐ No ☐

[29] If more than one incinerator is operated please repeat the same procedure for each incinerator separately.

Is there dark smoke emission for more than 3 minutes continuously at any time? Yes ☐ No ☐

20. Is any open burning conducted on the premises? Yes ☐ No ☐

If yes,

Describe the material burned and frequency of burning

_____

_____

What is the average daily quantity burned?

_____

21. Is there a regular maintenance programme for the incinerator? Yes ☐ No ☐

If yes, describe the methodology and the aims of such programmes

_____

_____

_____

_____

_____

22. Provide in the table below, the characteristics of the air emissions generated

Pollutants Generated by the Incinerator			
Pollutants	Value at Start-up	Value at 30 Minutes	Value at 2 Hours
CO_2			
CO			
NO			
NO_2			
NO_x[30]			
SO_2			
SO_3			
SO_x[31]			
Dust			
Other			

23. What are the types of air pollution control equipment used to improve the incinerator's stack emission quality?

24. Comments/Remarks

[30] If showing results in [mg/m³], calculate concentration as NO_2.
[31] If showing results in [mg/m³], calculate concentration as SO_2.

STACKS

25. **What is the total number of stacks?** _____

26. **Fill in the table below with required information concerning stack(s)**

Stack General Information					
Stack #	**Location**	**Height**	**Diameter**	**Receives Emission From**	**Filtering Systems, if Any**
1	*North Corner*	*7 m*	*0,5*	*Generator*	*n.a.*

27. **In the table below, provide information concerning the stack condition**

Stack Condition	
Stack #	**Condition**
1	*Damaged – Bad Condition*

28. **Average height of the surrounding buildings or vegetation?** _____ **m**

29. **Does the plant conduct any stack emissions quality monitoring?** **Yes** ☐ **No** ☐

If yes,

What is the frequency of monitoring?

_____

_____

What are the substances monitored[32]?

[32] If available, please photocopy the most recent monitoring results.

VOLATILE ORGANIC COMPOUNDS

For any VOC emissions originating from the production process, please refer to the process checklist.

30. **Name of VOC[33]** _____

31. **Source of VOC** _____

32. **What is its vapour pressure (Psi at standard conditions)?** _____

33. **Is it stored in bulk or containers or both?** _____

34. **If stored in bulk,**

What is the tank volume? _____

What is the annual throughput? _____

35. **Is there a dip pipe?** Yes ☐ No ☐

36. **Is there vapour recovery?** Yes ☐ No ☐

37. **Is there vapour destruction?** Yes ☐ No ☐

38. **Are there any control systems?** Yes ☐ No ☐

If yes, what type of control systems?

_____

_____

39. **Are the pumps, compressors, and other rotary equipment used for handling VOCs equipped with mechanical seals?** Yes ☐ No ☐

[33] Please repeat the same procedure for each VOC emitted.

40. **Are there routine inspections for VOC leaks?** **Yes** ☐ **No** ☐

If yes, describe a typical inspection

ASBESTOS

41. **Is there any material containing asbestos on the premises?** **Yes** ☐ **No** ☐

If yes,

Where is it located?

_____

_____

How much is there (quantity)?

_____

_____

What is the type of asbestos?

_____

_____

What is its composition?

_____

_____

What is its physical condition?

_____

_____

If asbestos is to be found on the premises, it should be considered to be a hot spot. Its location should be clearly stated and noted in the final report to allow the necessary action to be taken..

OZONE DEPLETING SUBSTANCES

42.	**Does the plant use chlorofluorocarbons (CFC)?**	**Yes** ☐	**No** ☐	
43.	**Does the plant use halons?**	**Yes** ☐	**No** ☐	
44.	**Does the plant use methyl chloroform?**	**Yes** ☐	**No** ☐	
45.	**Does the plant use carbon tetrachloride?**	**Yes** ☐	**No** ☐	
46.	**Does the plant use methyl bromide?**	**Yes** ☐	**No** ☐	
47.	**Does the plant use hydrobromofluorocarbons (HBFC)?**	**Yes** ☐	**No** ☐	
48.	**Does the plant use hydrochlorofluorocarbons (HCFC)?**	**Yes** ☐	**No** ☐	

If any of the above agents are to be found on the premises, they should be considered to be hot spots. Their locations should be clearly stated and noted in the final report to allow the necessary action to be taken.

ODOURS

For any odours emanating from the production process, please refer to the production process checklist. If necessary, add odours as input (if raw material) or output generated through the production process.

49. **Have any odours been detected in the facility?** **Yes** ☐ **No** ☐

If yes, write down the location(s) of such odours

_____

_____

50. **List the possible cause(s) of the detected odours**

_____

_____

51. **Have any actions been undertaken to control such odours?** **Yes** ☐ **No** ☐

If yes, describe the measures undertaken to control odour emissions

_____

_____

_____

_____

_____

STORAGE TANKS

52. **Does the plant have any fuel storage tanks?** Yes ☐ No ☐

If yes[34],

What is the content of the storage tank? _____

When was the storage tank installed? _____

What is the volume of the tank (m^3)? _____

Is it located above or below the ground? _____

Annual amount stored (m^3)? _____

Is there a dip pipe? Yes ☐ No ☐

53. **Does it have any ventilation valves?** Yes ☐ No ☐

If yes, are there vapour releases from the ventilation valves?

_____

_____

Other considerations

54. **Is there a regular leakage test for storage tanks?** Yes ☐ No ☐

If yes,

How often is this test conducted?

_____

_____

[34] Please repeat the same procedure for each generator operated at the facility.

Describe the methodology used to conduct such tests?

MITIGATION ACTION

55. **What are the actions taken to improve stack emissions quality?**

56. **What are the types of air pollution control equipment used?**

LEGAL ISSUES

57. **Does your plant adhere to any air emission regulations?** **Yes** ☐ **No** ☐

If yes, what are those regulations?

_____

_____

_____

_____

_____

58. **Is there an institution conducting routine air quality inspections at the? facility** **Yes** ☐ **No** ☐

If yes,

Write down the name of the institution?

_____

_____

How often does it conduct inspections?

_____

_____

If applicable, what are the dates of the three most recent inspections

_____

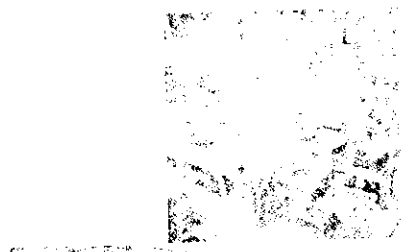
_____

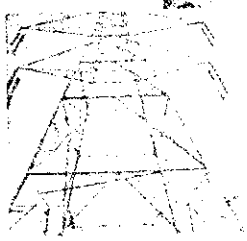
Write down any problems encountered during such inspections

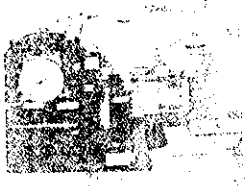
_____

_____

Include, if available a photocopy of the most recent inspection results.







AUDIT CHECKLIST
Solid Waste Management

AUDIT CHECKLIST: Solid Waste Management

GENERAL INFORMATION

Audit Site	
Audit Date	
Auditor(s)	
Site Personnel Responsible	

NOTES

SOLID WASTE MANAGEMENT PRACTICES

1. **Do you sort hazardous waste from non-hazardous waste?** **Yes** ☐ **No** ☐

If yes, describe the destination of each waste type

SOLID WASTE GENERATION

For the solid waste generated from the operational units, please refer to the production process checklist.

2. In the table below, complete the necessary information on solid waste generation

Solid Waste Generation				
Source of Generation	**Type of Solid Waste**	**Category**	**Quantity (kg/day)**	**Destination**
Office Management	*Non-hazardous*	*Mixed Similar to Household*	*60 kg/day*	*National Landfill*

GLASS

3. Is glass sorted? Yes ☐ No ☐

If yes, what are the colours sorted?

Green ☐

White ☐

Brown ☐

Not sorted into colours but kept mixed ☐

Other, specify

_____

_____

4. What is the destination of the sorted glass?

Re-used on-site ☐

Recycled off-site ☐

Other, specify (minimisation, reduction, etc.)

_____

_____

5. If glass is re-used on-site, what is the quantity re-used?

_____

6. If glass is sent for recycling off-site, what is the quantity recycled?

_____

7. What is the final destination of the recycled glass?

_____

PLASTICS

8. Are plastics sorted? Yes ☐ No ☐

If yes, what are the types sorted?

PVC ☐

PET ☐

HDPT ☐

LDPT ☐

Not sorted into types but mixed ☐

Other, specify (minimisation, reduction, etc.)

_____

9. What is the destination of the sorted plastic?

Re-used on-site ☐

Recycled off-site ☐

Other, specify

_____

10. If plastic is re-used on-site what is the quantity re-used?

_____

11. If plastic is sent for recycling off-site what is the quantity recycled?

_____

12. What is the final destination of the recycled plastic?

_____

METAL

13. Is metal sorted? Yes ☐ No ☐

If yes, what are the types sorted?

Iron / Steel ☐

Aluminium ☐

Copper ☐

Lead ☐

Not sorted into types but kept mixed ☐

Other, specify

_____

_____

14. What is the destination of the sorted metal?

Re-used on-site ☐

Recycled off-site ☐

Other, specify (minimisation, reduction, etc.)

_____

_____

15. If metal is re-used on-site, what is the quantity re-used?

_____

16. If metal is sent for recycling off-site, what is the quantity recycled?

_____

17. What is the final destination of the recycled metal?

_____

PAPER AND CARDBOARD

18. **Is paper sorted?** Yes ☐ No ☐

If yes, what are the categories sorted?

Cardboard ☐

White paper ☐

Newspaper ☐

Not sorted in categories but kept mixed ☐

Other, specify

_____

_____

19. **What is the destination of the sorted paper?**

Re-used on-site ☐

Recycled off-site ☐

Other, specify (minimisation, reduction, etc.)

_____

_____

20. **If paper is re-used on-site what is the quantity re-used?**

_____

21. **If paper is sent for recycling off-site, what is the quantity recycled?**

_____

22. **What is the final destination of the recycled paper?**

_____

OTHER WASTE TYPES

23. **Is organic waste sorted from other waste?** **Yes** ☐ **No** ☐

If yes, what is the quantity and destination of the sorted organic waste?

_____

_____

_____

_____

_____

24. **Is wood sorted from other waste?** **Yes** ☐ **No** ☐

If yes, what is the quantity and destination of the sorted wood?

_____

_____

_____

_____

_____

25. **Is other waste sorted?** **Yes** ☐ **No** ☐

If yes, describe type, quantity and destination of each type sorted

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

HAZARDOUS WASTES

26. **Do you sort the hazardous waste per category?** **Yes** ☐ **No** ☐

If yes, complete the table below with corresponding data

Hazardous Waste Generation					
Type	**Quantity Generated**	**Source of Generation**	**Storage**	**Treatment, if Any**	**Final Destination**
Infectious Waste	*30 Kg/month*	*Hospital Operating Theatre*	*Special Storage Room*	*n.a.*	*Incinerator*

27. **Draw below a flowchart representing the on-site waste treatment procedure**

WASTE TREATMENT FLOWCHART

SUMMARY

28. In the table below, describe the source, quantities and destination of solid waste generated

Solid Waste Summary			
Type of Waste	**Source**	**Overall Quantities**	**Final Destination**
Hazardous			
Non-hazardous			
Glass			
Metal			
Wood			
Plastics			
Cardboard/Paper			
Organic			

WASTE STORAGE

29. Is waste stored on-site? Yes ☐ No ☐

If yes,

For how long is it stored? _____

Is it pre-treated before storage? _____

What is the type of pre-treatment? _____

Are the storage containers labelled? _____

30. What type of containers are used for the different kinds of waste, describe?

_____

_____

_____

_____

_____

WASTE MINIMIZATION OPTIONS

31. Are there any waste minimisation programmes? Yes ☐ No ☐

If yes, describe the waste minimisation programmes

_____

_____

_____

_____

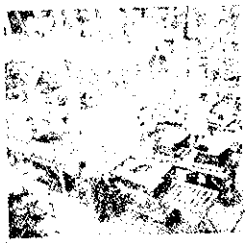
_____

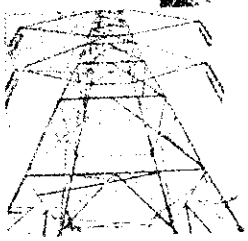
MISCELLANEOUS

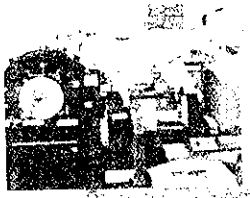
32. **Does the facility have an inactive burial site on its premises?** Yes ☐ No ☐

If yes, describe the type, quantity, and method of burial used (liner, geo-membranes, etc.)?

33. **Do you register the method of waste disposal?** Yes ☐ No ☐







AUDIT CHECKLIST
Noise Pollution

AUDIT CHECKLIST: Noise Pollution

GENERAL INFORMATION

Audit Site	
Audit Date	
Auditor(s)	
Site Personnel Responsible	

NOTES

NOISE POLLUTION

1. **In the table below, provide information about the facility's noise pollution**

Noise Pollution at Facility	
Noise Levels	**dB**
Storage Areas (Loading, De-loading)	
Operation Areas	
Unit 1	
Unit 2	
Unit 3	
Unit 4	
Overall Noise Level at Facility	

2. **In the table below, provide information about the noise pollution outside the facility**

Noise Pollution Outside Facility	
Noise Levels	**dB**
Corner1	
Corner2	
Corner3	
Corner4	

3. **Are there any devices installed to minimise noise?** **Yes** ☐ **No** ☐

If yes, where are they installed?

AUDIT CHECKLIST: Energy Consumption

AUDIT CHECKLIST: Energy Consumption

GENERAL INFORMATION

Audit Site	
Audit Date	
Auditor(s)	
Site Personnel Responsible	

NOTES

GENERAL

For energy consumed by operational units, please refer to the production process checklist.

1. **If applicable, write down the name of the person responsible for energy management**

Name _____

Title _____

Telephone _____

2. **List the different types of energies used in the audited facility**

Electricity ☐

Heat ☐

Steam ☐

Hydraulic ☐

Other, specify

_____

_____

3. **List the different energy sources used in the audited facility**

Heavy fuel ☐ **Light fuel** ☐

Diesel ☐ **Petrol** ☐

Propane ☐ **Renewable energies** ☐

Coal ☐

Other, specify

_____

4. **What is the primary energy mainly used (electricity, heat, steam, etc.)?**

5. **Has an audit been undertaken to identify energy consumption and minimisation?** **Yes** ☐ **No** ☐

If yes,

Write down the name of the agency that conducted the audit

What was the outcome of such an audit? Were any corrective measures undertaken accordingly?

6. **List by order of importance the main energy consuming divisions in the**

facility (operational department, storage room, administrative department, car park, etc.)

Distribution of Energy Consumption per Division	
Energy Consumption Level	**Division's Name**
Highest Energy Consuming Division(s)	
Average Energy Consuming Division(s)	
Lowest Energy Consuming Division(s)	
Other	

7. **List by order of importance the main energy consuming applications**

Energy Consumption per Application		
Name of Equipment or Process, etc. (i.e. Air Conditioning, Heating Unit, etc.)	**Age of Equipment**	**Name of Division Where Equipment is Located (i.e. Operational Department, etc.)**

Other, specify

_____

_____

8. **Are there defined maintenance programmes to ensure that all machinery and auxiliary equipment operate at optimal efficiency?** **Yes** ☐ **No** ☐

If yes, describe the regular maintenance programmes below (where and when they are applied)

_____

_____

_____

_____

_____

9. **Is energy efficiency taken into consideration when purchasing new equipment?** **Yes** ☐ **No** ☐

10. **Is there a desire to replace any high energy consuming equipment?** **Yes** ☐ **No** ☐

If yes,

Specify which equipment, when and how

_____

_____

Specify advantages and disadvantages of such replacement programmes

_____

_____

ELECTRICITY

11. **Describe the governmental tariff scheme applied to the facility (i.e. fixed rates, other)**

12. **What is the average monthly electricity consumption (i.e. total kWh/month)?**

13. **Specify in percentage the total amount of electricity used from governmental sources and the percentage covered by generator usage or renewable energy sources.**

Electricity Consumption per Source	
Source	**Percentage**
Governmental Electricity	
Generator	
Other (Renewable Energies, etc.)	
Total	100%

14. **What is the average monthly electricity bill?**

15. **Describe the strategy applied to reduce electricity consumption during peak hours**

16. **Are penalties being paid for the power factor?** **Yes** ☐ **No** ☐

If yes, what types of measures are applied to increase the power factor?

_____

_____

17. **Are there any monitoring programmes for electricity consumption[35]?** Yes ☐ No ☐

18. **In the table below, provide a breakdown of the main electricity consuming applications (i.e. production process, air-conditioning systems, lighting systems, etc.) by order of importance**

Main Electricity Consuming Applications		
Name of Application	**Location**	**% Electricity Used out of Total Electricity Consumption**

For information relevant to generator usage, please refer to the air emissions checklist.

[35] The data provided in the table will be more relevant, if a regular monitoring programme is in force.

FUEL CONSUMPTION

19. In the table below, provide a breakdown of the main fuel consumed by applications (i.e. production process, heating systems, lighting systems, etc.) by order of importance

Fuel Consumption per Application			
Fuel Type	Application	% Consumption	Observations (Leakages, Old Machinery, Bad Maintenance, etc.)

20. Are there any monitoring programmes for fuel consumption? Yes ☐ No ☐

If yes, describe the aim and purpose of these programmes

RENEWABLE ENERGIES

21. **Are renewable energies used?** **Yes** ☐ **No** ☐

If yes,

Describe the type of renewable energies used

_____

_____

_____

_____

_____

When and where are the renewable energy sources used?

_____

_____

_____

_____

_____

What are the total savings achieved through the usage of renewable energies?

_____

_____

_____

_____

_____

STRATEGIES TO REDUCE AND MONITOR ENERGY CONSUMPTION

22. **Are any energy saving programmes planned for the future?** **Yes** ☐ **No** ☐

If yes, please describe the purpose of such energy saving programmes

23. **Are there any energy monitoring programmes planned for the future?** **Yes** ☐ **No** ☐

If yes, please describe the purpose of these monitoring programmes

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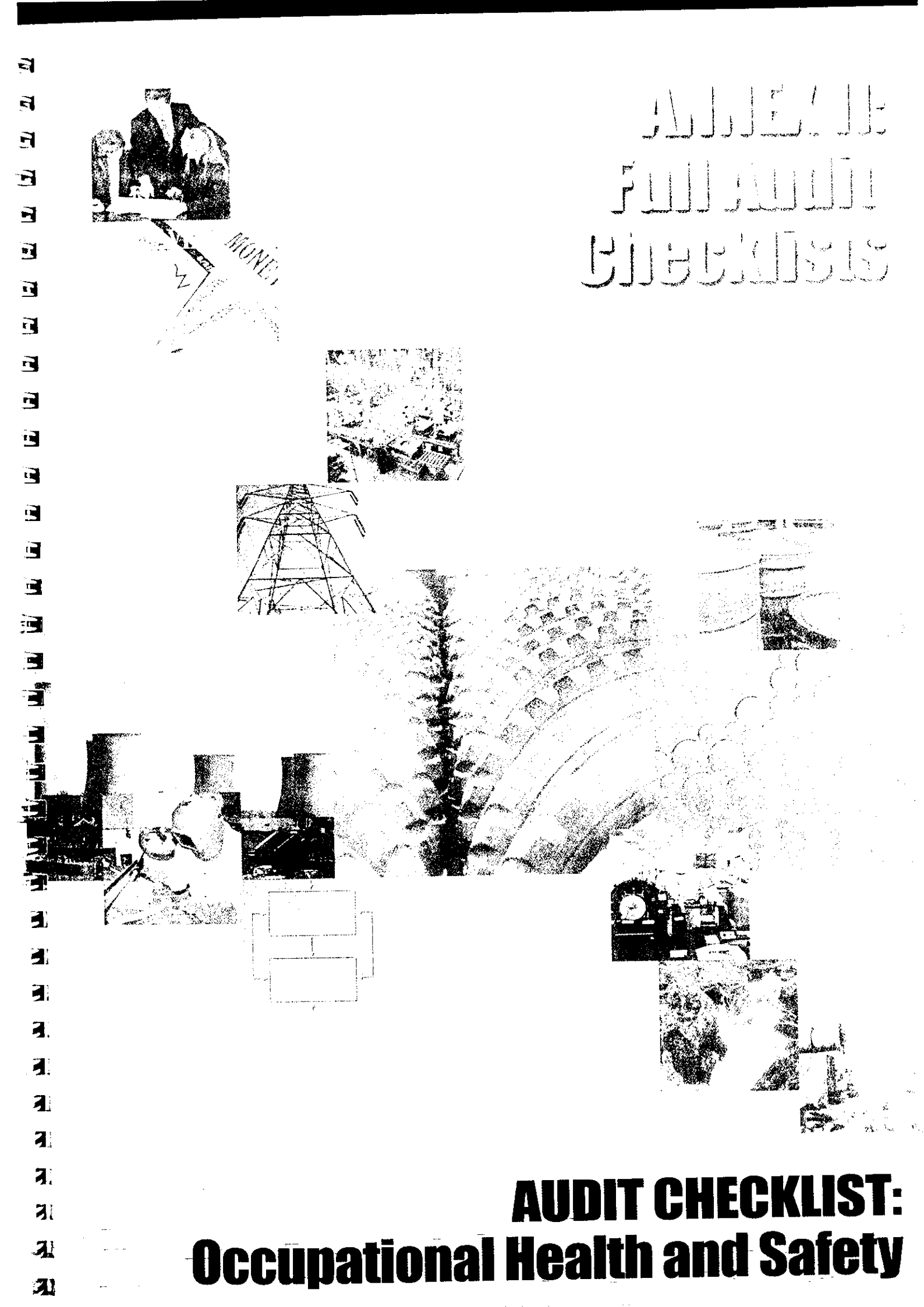
مكتب وزير الدولة لشؤون التنمية الإدارية
مركز مشاريع ودراسات القطاع العام



AUDIT CHECKLIST:
Occupational Health and Safety

AUDIT CHECKLIST: Occupational Health and Safety

GENERAL INFORMATION

Audit Site	
Audit Date	
Auditor(s)	
Site Personnel Responsible	

NOTES

INDOOR AIR QUALITY

1. **Does the plant conduct indoor air quality monitoring?** Yes ☐ No ☐

If yes,

2. **What is the frequency of monitoring?**

_____

_____

3. **What are the substances monitored[36]?**

_____

_____

4. **Fill the indoor air quality characteristics into the table below**

Indoor Air Quality Characteristics				
Type of Pollutant	**Location of Monitoring**	**Value**	**Method**	**Frequency & Date**

[36] If available, please photocopy the most recent monitoring results.

PERSONAL PROTECTIVE EQUIPMENT

5. Is personal protective equipment (PPE) provided? Yes ☐ No ☐

   If yes, are the workers obliged to wear it? Yes ☐ No ☐

   Is PPE assigned to every individual? Yes ☐ No ☐

   If no, which individuals are assigned PPE?

   _____

   _____

6. In the table below, provide information about PPE usage

PPE Usage				
Type of PPE	Intended Use	What Job, if Any Requires the Full-Time Use of PPE	How Often Is it Maintained	Who Is Responsible for Maintenance

7. Where is PPE stored?

   _____

   _____

8. Are employees trained on PPE usage? Yes ☐ No ☐

9. How often is fit testing conducted?

   _____

   _____

SAFETY

10. Does the facility have any safety rules? Yes ☐ No ☐

11. Have the personnel been trained to apply these safety rules? Yes ☐ No ☐

12. Is there an emergency action plan? Yes ☐ No ☐

13. Have there been any emergencies in the past? Yes ☐ No ☐

If yes, describe type and mitigation actions taken

_____

_____

14. Is there a fire protection plan? Yes ☐ No ☐

15. Are there fire extinguishers? Yes ☐ No ☐

16. Have fire alarms been installed? Yes ☐ No ☐

17. Are there safety showers and eyewash stands at all needed locations? Yes ☐ No ☐

18. Have ventilation controls been installed? Yes ☐ No ☐

19. Are appropriate ventilation systems placed in confined areas?

_____

_____

20. Is maintenance performed regularly on ventilation equipment? Yes ☐ No ☐

21. Is there appropriate lighting? Yes ☐ No ☐

22. What type of lighting does the facility depend on (artificial, natural or both)?

_____

_____

23. Are Material Safety Data Sheets (MSDS) available for all chemicals used? Yes ☐ No ☐

24. Is maintenance performed regularly on all machinery? Yes ☐ No ☐

25. Are machines properly guarded to protect workers' hands, fingers, hair? Yes ☐ No ☐

26. Are aisles clear? Yes ☐ No ☐

27. Are fire exits well marked and accessible? Yes ☐ No ☐

28. Are floor surfaces free of debris and slipping hazards? Yes ☐ No ☐

29. Are there any areas with warning signs regarding health concerns, protective measures, eating and smoking restrictions? Yes ☐ No ☐

If yes, specify

_____

_____

30. **Are there certain jobs with high levels of absenteeism, illness, or employee turnover?** **Yes** ☐ **No** ☐

If yes, specify

_____

_____

EMPLOYEE EXPOSURE MONITORING

31. **Is exposure monitoring being conducted?** Yes ☐ No ☐

If yes,

What type of monitoring does it cover (noise pollution, indoor air quality, etc.)?

_____

_____

What is the monitoring method?

_____

_____

How often is it conducted?

_____

_____

How are results used to prevent exposure?

_____

_____

32. **Have there been any occupational accidents in the past two years?** Yes ☐ No ☐

If yes,

What were the circumstances?

_____

_____

What were the measures implemented to deal with such issues?

_____

_____

Is there dust, smoke, or mist in the air? Yes ☐ No ☐

If yes, specify

_____

_____

33. Are there accumulations of dust, liquid or oil on machine surfaces or the floor? Yes ☐ No ☐

If yes, specify

_____

_____

34. Have you noticed any odours, had a bad taste in your mouth, experienced burning eyes? Yes ☐ No ☐

35. Is there a baseline health check? Yes ☐ No ☐

36. Are employees required to have a shower after work? Yes ☐ No ☐

37. Are workers required to wear any special uniforms? Yes ☐ No ☐

If yes, specify who (all workers, some workers, special types of workers, etc.)

_____

_____

38. Do employees leave their working clothes at work? Yes ☐ No ☐

If yes, how is laundry handled?

_____

_____

LEGAL ISSUES

39. **Are employees eligible for daily breaks?** **Yes** ☐ **No** ☐

If yes, specify (when, length of breaks, etc.)

_____

_____

40. **Are employees covered by any kind of health insurance?** **Yes** ☐ **No** ☐

If yes, specify (who, how much, etc.)

_____

_____

41. **Are employees registered in the social security system?** **Yes** ☐ **No** ☐

If yes, specify

_____

_____

42. **Comments/ Remarks**

_____

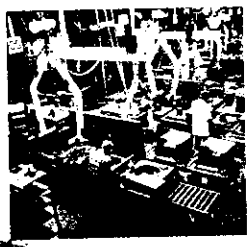
_____

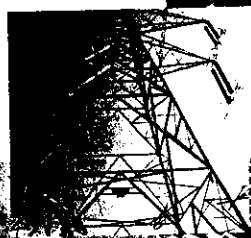
_____

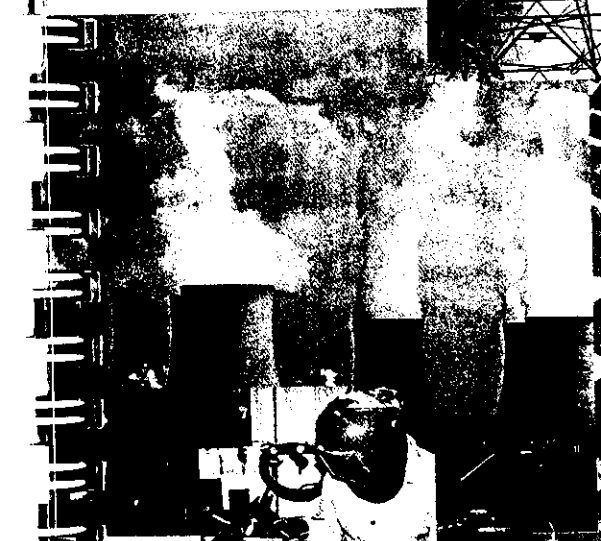
_____

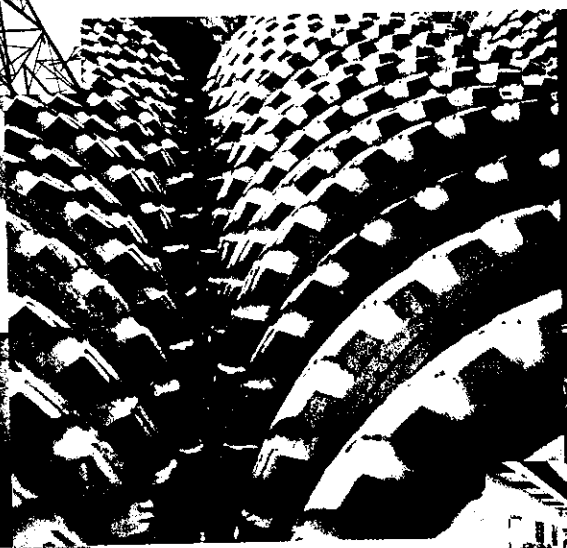
_____

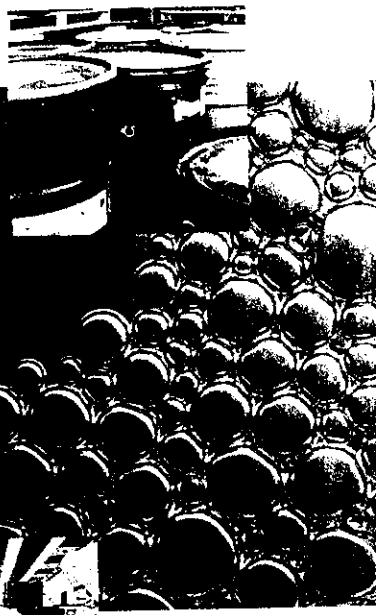
ANNEX III: Sampling Checklists

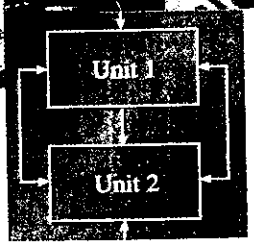












The tables below provide a list of the primary pollutants to be measured while conducting an environmental audit. The tables are divided according to the main industrial sectors as well as the type of pollution to be analyzed (i.e. wastewater generation or air pollution). However, this is not to be considered as an exclusive list as additional pollutants may need to be tested.

WASTEWATER SAMPLES

Industry \ Pollutant	pH	Temperature	BOD	COD	Suspended Solids	AOX	Hydrocarbons	Phenolic Compounds	Oil and Grease	Total Carbon	Bioassay test[1]	Coliform Bacteria	Ammoniacal Nitrogen	Aluminum	Arsenic	Cadmium	Cr (total)	Cu (total)	Hexavalent Chromium	Iron (total)	Lead (Pb)	Mercury	Nickel	Vanadium	Zinc	Total Metal	Total Nitrogen	Total Phosphorous	Chloride	Cyanides	Fluoride (F)	Nitrate Nitrogen	Phosphate	Sulfate	Sulfide
Aluminum Manufacturing	√	√		√	√		√				√			√						√	√	√	√		√			√			√				
Battery Manufacturing	√			√	√	√				√	√		√		√	√		√		√	√	√	√		√		√	√							
Breweries	√	√	√	√	√				√				√														√	√							
Cement Industry	√	√			√				√																		√	√		√					
Chemical (Inorganic)	√			√	√				√		√					√	√	√	√		√	√	√		√	√	√	√		√					√
Chemical (Organic)	√		√	√	√	√		√	√	√	√				√		√	√			√				√		√	√		√	√				√
Petro-Chemicals	√		√	√	√	√	√	√									√		√								√	√		√	√				√
Dairy Industry	√	√	√	√	√				√			√															√	√							
Edible Oil & Vanaspati	√	√	√	√	√				√																										
Electroplating Industry	√	√		√	√	√	√		√		√		√	√	√	√	√	√	√	√	√		√		√	√		√	√	√					√
Fertilizer Industry	√				√				√				√		√				√					√			√			√		√			
Flour Mills	√		√	√	√				√																		√	√							
Food and Beverage	√		√	√	√				√				√																						
Glass Industry	√			√	√				√						√		√	√			√		√							√			√		
Integrated Iron & Steel	√	√		√	√	√	√	√	√		√		√		√	√	√	√		√	√		√		√					√					
Paint Industry	√			√	√				√		√		√			√	√	√	√	√	√		√		√	√							√	√	√
Pesticide Industry	√		√	√	√	√			√		√				√			√				√			√					√		√	√		
Power Plants	√	√			√				√								√	√	√	√			√		√				√						
Pulp and Paper Products	√		√	√	√				√																										
Plastic	√		√	√	√	√		√	√																										

[1] Toxicity against fish

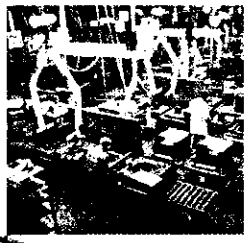
Industry \ Pollutant	Rubber	Tanneries	Steel Mills	Textiles
pH	✓	✓	✓	✓
Temperature			✓	
BOD	✓	✓	✓	✓
COD	✓	✓		✓
Suspended Solids	✓	✓	✓	✓
AOX	✓	✓		✓
Hydrocarbons				
Phenolic Compounds	✓			✓
Oil and Grease	✓	✓	✓	✓
Total Carbon				
Bioassay test[1]		✓		✓
Coliform Bacteria				
Ammoniacal Nitrogen		✓		✓
Aluminum				
Arsenic				
Cadmium			✓	
Cr (total)		✓	✓	✓
Cu (total)			✓	
Hexavalent Chromium		✓	✓	
Iron (total)			✓	
Lead (Pb)			✓	
Mercury				
Nickel			✓	
Vanadium				
Zinc	✓			
Total Metal				
Total Nitrogen				
Total Phosphorous		✓		
Chloride		✓		
Cyanides				
Fluoride (F)				
Nitrate Nitrogen				
Phosphate				
Sulfate		✓		
Sulfide		✓		✓

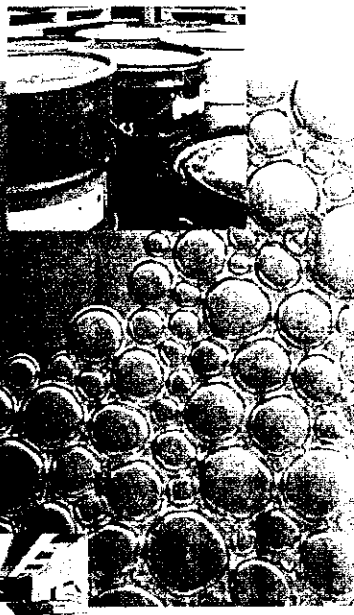
AIR QUALITY SAMPLES

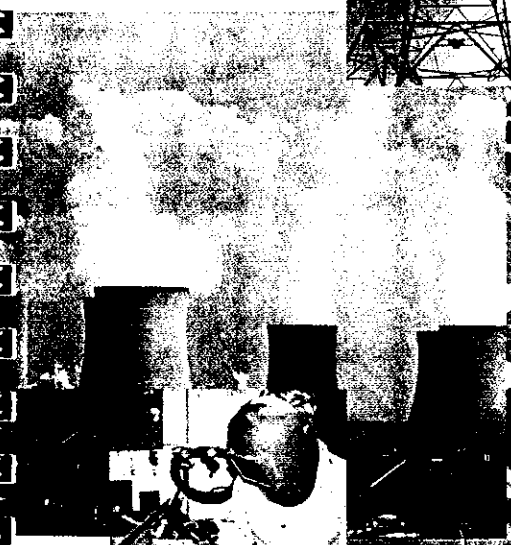
Industry \ Pollutant	CO	CO_2	SO_2	SO_3	SO_x	NO	NO_2	NO_x	Dust	Arsenic	Cadmium	Lead (Pb)	Mercury	Heavy metals	Total Metals	Ammonia (NH_3)	Chlorine	Hydro Chloric Acid (HCL)	H_2S	Sulfuric Acid	Dioxin	Furane	Fluorides	VOC	Total Carbon	Odors
Generator	√	√	√	√	√	√	√	√	√																	
Boiler	√	√	√	√	√	√	√	√	√																	
Incinerator	√	√	√	√	√	√	√	√	√	√	√	√		√	√	√	√	√	√		√	√	√	√		√
Aluminum Manufacturing			√						√								√			√			√	√		
Battery Manufacturing									√		√	√	√													√
Breweries																										
Cement Industry			√	√	√	√	√	√	√																	
Chemical (Inorganic)			√	√	√	√	√	√									√		√					√		
Chemical (Organic)																										
Petro-Chemicals			√	√	√	√	√	√	√										√							
Dairy Industry									√																	√
Edible Oil & Vanaspati									√																	√
Electroplating Industry														√										√		
Fertilizer Industry	√	√	√	√	√	√	√	√	√							√							√			
Flour Mills									√																	√
Food Industries																										
Glass Industry			√	√	√	√	√		√	√	√	√			√	√	√	√					√			
Integrated Iron & Steel			√	√	√	√	√	√	√														√			
Paint Industry																								√		
Pesticide Industry									√								√							√		
Power Plants	√	√	√	√	√	√	√	√	√																	

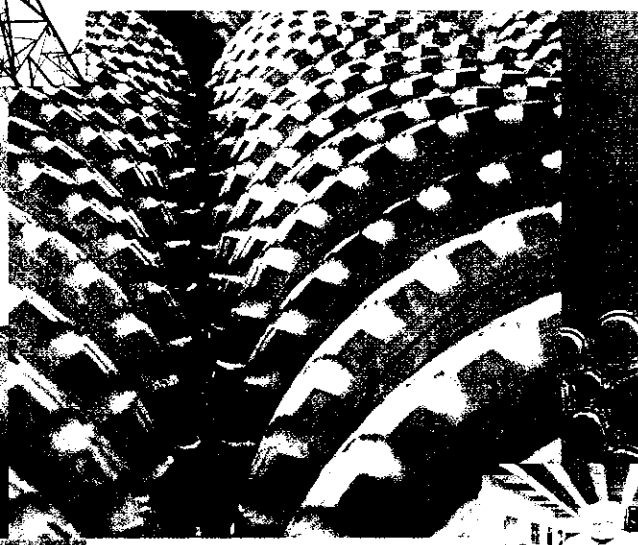
Industry \ Pollutant	CO	CO_2	SO_2	SO_3	SO_x	NO	NO_2	NO_x	Dust	Arsenic	Cadmium	Lead (Pb)	Mercury	Heavy metals	Total Metals	Ammonia (NH_3)	Chlorine	Hydro Chloric Acid (HCL)	H_2S	Sulfuric Acid	Dioxin	Furane	Fluorides	VOC	Total Carbon	Odors
Pulp and Paper Products			√				√		√										√					√		
Plastic											√	√												√		
Rubber															√						√			√		
Tanneries																√			√					√		
Steel Mills									√						√				√					√		√
Textiles																			√					√		

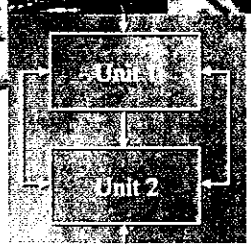
ANNEX IV: National Environmental Auditing Manual: PRESENTATION

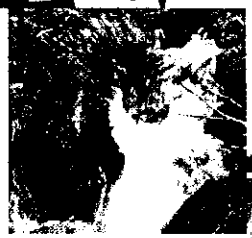


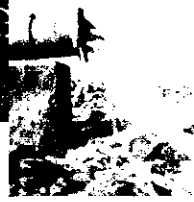












DEFINITION OF AN ENVIRONMENTAL AUDIT

The Environmental Audit is a documented, periodic and objective process, which assesses a facility's operation with respect to the environment as well as health & safety.

It is the first step in an on-going programme, which entails documentation, implementation and continuous follow-up of the Action Plan resulting from the audit to optimize resource use and improve process performance.

TYPES OF ENVIRONMENTAL AUDITING

There are many different types of audits, which respond to different needs, namely:

- *Compliance Audits*
- *Waste Audits*
- *Risk Audits*
- *Environmental Management Audits*
- *Environmental Liability Definition Audits*
- *Waste Contracting Audits*

THE NATIONAL ENVIRONMENTAL AUDITING MANUAL (1)

▶The Ministry of Environment designed a detailed National Environmental Auditing Manual in order to unify auditing procedures and methods at operating industrial facilities.

THE NATIONAL ENVIRONMENTAL AUDITING MANUAL (2)

The manual covers the following issues entirely:

- Environmental management practices
- Processes used
- Water consumption
- Waste water management
- Air quality & gaseous emissions
- Solid waste management
- Noise pollution
- Energy consumption
- Occupational health and safety

Republic of Lebanon
Office of the Minister of State for Administrative Reform
Center for Public Sector Projects and Studies
(C.P.S.P.S.)

However, the manual **could be tailored** to fit the different needs of various industrial sectors.

OBJECTIVES OF THE NATIONAL ENVIRONMENTAL AUDIT

- Assessment of compliance with government legislation, regulations, guidelines, codes of practice and permit conditions
- Assessment of adherence to internal policy and procedures
- Assessment of the status of current practice
- Identification of efficiency potentials and areas for improvement to minimize the impact on the environment

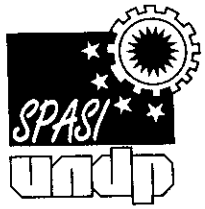
BENEFITS OF ENVIRONMENTAL AUDITING

- ▶ Promoting good environmental management
- ▶ Ensuring cost-effective compliance with laws, regulations, standards and company policy
- ▶ Improving employee productivity, awareness and safety at work
- ▶ Reducing operation costs
- ▶ Incorporating the environmental dimension in a facility's operation
- ▶ Triggering new priorities in policies and practices
- ▶ Improving the image of the facility and enhancing competitiveness
- ▶ Obtaining certification from the Ministry of the Environment

THE AUDIT PROCEDURE

THREE PHASES OF AN ENVIRONMENTAL AUDIT

STEP 1 Pre-Audit	OBJECTIVE • To make the necessary preparations and arrangements for the on-site audit.
STEP 2 On site Audit	OBJECTIVES • To assess compliance with government legislation, regulations, guidelines, and permit conditions; • To assess adherence to internal policy and procedures; • To identify areas of improvement to minimize the impact on the environment.
STEP 3 Post-Audit	OBJECTIVES • To produce an Audit Report that includes the findings and recommendations; • To promote the development of an Action Plan for the continual improvement of operations; • To develop / adjust the environmental management system.



STEP 1: Pre-Audit/ Audit Planning and Preparation

- Setting objectives and scope
- Forming and organizing the audit team
- Overview of the type of facility
- Visiting the top management
- Conducting detailed background research
- Tailoring the pre-audit questionnaire
- Tailoring of checklists
- Assigning tasks, responsibilities and timetable

STEP 2: On-site Audit

- ▶ Introductory meeting with staff
- ▶ Assessing the legal status and environmental management
- ▶ Detailed on-site inspection
  - *Production Process*
  - *Water Supply*
  - *Wastewater Management*
  - *Air Emissions*
  - *Solid Waste Management*
  - *Noise Pollution*
  - *Energy Consumption*
  - *Occupational Health and Safety*
- ▶ Data analysis
- ▶ Concluding meeting

STEP 3: Post-audit

This phase focuses on final stages of the audit and covers the following issues:

- Audit Report
- Action Plan

AUDIT REPORT

The audit report must cover the following issues:

- Introduction
- Site description
- Results/ findings and recommendations

The findings are classified with respect to their urgency and risk to public health ('hotspots').

ACTION PLAN

- ▶ Compliance strategy
- ▶ Areas for further investigation
- ▶ Blueprints for environmental auditing program
- ▶ Blueprints for an environmental awareness and training program
- ▶ Development of indicators
- ▶ Blueprints for a progress monitoring program
- ▶ Time frame for implementation

Republic of Lebanon
Office of the Minister of State for Administrative Reform
Center for Public Sector Projects and Studies
(C.P.S.P.S.)

BACKGROUND INFORMATION

Financed by:
European Union
Managed by:
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Executed by:
Ministry of Environment

الجمهورية اللبنانية
مكتب وزير الدولة لشؤون التنمية الإدارية
مركز مشاريع ودراسات القطاع العام

GOAL

To strengthen the permitting, monitoring and auditing system for industries through the development of necessary legislation and the introductio of adequate tools.

OBJECTIVES

- Set/update decrees for classified establishments;
- Set/update standards for environmental quality;
- Design the national environmental auditing manual;
- Strengthen the capacity for environmental monitoring procedures;
- Develop compliance action plans, (CAP);
- Spread awareness concerning industrial compliance;
- Build the capacity of concerned parties to conduct CAP, environmental audits and monitoring;
- Facilitate environmental compliance in selected priority industries through the introduction of economic instruments.

Republic of Lebanon
Ministry of Environment

SPASI
Strengthening the Permitting & Auditing System for Industries

Life
European Union
Life 3rd Countries Programme

undp
United Nations
Development Programme