Ministry of State for Environmental Affairs

Egyptian Environmental Affairs Agency (EEAA)

Egyptian Pollution Abatement Project (EPAP)

Self Monitoring Manual

General Guidebook

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PREFACE

The Egyptian Pollution Abatement Project (EPAP) sponsored by FINIDA has assigned Finish and Egyptian consultants for the task of developing Sector specific inspection and monitoring guidelines. This task is based on a previous collaboration between FINIDA and EPAP that resulted in the development of four Inspection Guidelines:

- Fundamentals and Background Manual that provides basic information about air pollution, wastewater characteristics, solid waste, hazardous materials and wastes and work environment.
- Guidelines for Inspectorate Management that discusses the strategy, objectives and tasks of the Inspectorate management.
- Guidelines for Team Leaders that identifies the team leader responsibilities and tasks.
- Guidelines for Inspectors that presents a methodology for performing all types of inspection. Tasks during the various phases of planning, performing field inspection, report preparation and follow-up are discussed. Several checklists are included.

The three guidelines were later summarized into one referred to as the Inspection Guidelines. A General Inspection Manual, GIM, was also developed to cover the aspects common to all sectors.

On the other hand, EPAP realized the need to introduce the concept of self-monitoring, as it provides useful information to the plants' management on the production efficiency as well as the environmental status. Self-monitoring should cover, as a minimum, the monitoring of the releases to the environment including emissions to air, wastewater, solid waste and hazardous waste. A comprehensive self-monitoring plan may cover process parameters that would affect the environmental impacts. Such plan would assist the management to identify sources of waste, prevent pollution at the source, reduce emissions, and achieve economic benefits.

Therefore, a Self-Monitoring Guidebook was also developed, in 1999, to present the industrial community, the consultants, and government officials with the general principles and both managerial and technical aspects to be followed for self-monitoring. The textile industry was chosen as a case study for implementing and testing the manual and a self-monitoring manual for this industry was developed.

Various training programs reflected the need for sector-specific guidelines, and EPAP took the initiative to develop such manuals. Five sectors were chosen:

- Food Industry with specific reference to the five sub-sectors of Dairy products, Vegetables and Fruit processing, Grain Milling, Carbonated Beverages and Confectionery.
- Pulp and Paper Industry
- Metallurgical Industry with specific reference to the two sub-sectors of Iron and Steel and Aluminum.
- Engineering Industry with specific reference to Motor Vehicles Assembly and Fabricated Metals industries.
- Textile Industry.

The project aimed at the development of sector-specific guidelines for inspection and monitoring to be used by inspectors and plant personnel respectively. Each manual was tested by industrial experts from each of the above-mentioned sectors.

To maximize the benefits from the self-monitoring manuals, and to extend the coverage to other industrial sectors, EPAP took the initiative to develop this “General Environmental Self-Monitoring Manual”, based upon the accumulated experience since publishing the first edition in 1999. This manual includes the most important material that was published in the first edition; in addition to examples and information from the sector-specific manuals. In the future, this manual could be further improved by adding to it case studies and success stories of actual implementation fro plants that developed, implemented, and operated self-monitoring systems in various industrial sectors.

Organization of the Self-Monitoring Manual:

All the information and steps needed to develop and establish a self-monitoring system are detailed in the following eight chapters. Chapter one presents a brief summary including a definition of self-monitoring, its objectives and benefits, in addition to its relationship to each of environmental management systems and cleaner production. Chapter two details the requirements for establishing a self-monitoring system; whereas chapter three discusses various methods of self-monitoring; and chapter four presents issues related to monitoring raw materials, utilities, and products. Aspects related to operation controls are presented in chapter five; while chapter six is focusing on environmental self-monitoring. Data collection, processing and utilization is discussed in chapter seven; while chapter eight is devoted to aspects related to improving self-monitoring. Two annexes are included in this document, Annex (A) presents a sample of the Environmental Register, and Annex (B) presents the legal requirements for compliance.

INTRODUCTION

Self-monitoring represents an essential activity in modern industry as it is the means for monitoring environmental performance. It is also used to measure the degree of compliance with legal requirements, how production processes are performed, and also the efficiency of raw material and fuel use. Monitoring is also considered the basis for improvement, whether for industrial processes or for the facility as a whole. Finally, we will present three important definitions, and the nine principles that form the foundations for the establishment of an effective and sustainable self-monitoring system; then we focus on the importance of management commitment and its understanding of the role of self-monitoring in the development of the industrial establishment in general, and improving its environmental performance in particular.

Self-Monitoring:

Monitoring of use of raw material, energy and utilities, process operation and controls, discharges and emissions carried out by and paid for by the industrial establishment or carried out on behalf and paid for by the industrial establishment. It is normally carried out on the basis of a sampling program and includes tracking trends over time. The information obtained from a sampling and monitoring system must be recorded and the results have to be reported to the appropriate internal & external decision-makers.

A self-monitoring system (SMS):

It is a mechanism with clearly defined objectives, responsibilities, planned activities, practices, procedures, processes and resources. Its objectives are monitoring inputs, emission outputs and operation of process in order to meet the objectives set by the facility and continually improving the self-monitoring system.

A self-monitoring plan:

It is a written document presenting the objectives, responsibilities, resources, methods, and procedures to implement self-monitoring and meet the objectives. The self-monitoring plan is the main tool of the self-monitoring system and its reference document.

Principles for Building a Self-Monitoring System

A self-monitoring system can be built at many different levels and have a more or less wide scope. A self-monitoring system is absolutely facility specific. However, these general and essential principles are valid, whatever the scope, coverage, or degree of sophistication of the self-monitoring system.

1. **Principle of commitment and responsibility.** Support from top management is essential to the overall success of a self-monitoring system. Local management ensures that the monitoring plan set forth is in place, with clear accountability for implementation. In addition, responsibilities have to be clearly defined.

2. **Principle of integration.** Self-monitoring is seen as an integral part of the maintenance and operation of an existing facility and as an integral part of design, construction, operation and maintenance of a facility. Self-monitoring should be taken into account from the conception phase of new facilities and installations. For example all monitoring devices and equipment should be built in the process.

3. **Principle of exhaustiveness.** Self-monitoring covers all the chain from inputs via process to controls and discharges (outputs).

4. **Principle of simplicity, reliability and feasibility.** A self-monitoring program should be feasible in the context of the facility. When planning and implementing a self-monitoring program get as reliable data as possible, without spending too much money. All results of self-monitoring should be reliable. It is important to have simple, meaningful measures of assessment, and achievable targets whose cost can be estimated and used to demonstrate sustainable environmental benefit.

5. **Principle of sustainability.** A good self-monitoring system and a well-designed and implemented self-monitoring plan will bring the facility substantial savings without entailing heavy investment. The companies should therefore reinvest part of the savings to improve the self-monitoring system (invest in equipment, maintenance, training…) in order to reach self-sustainability. Self-sustainability is reached when the cost of the self-monitoring activities is usually paid for with the gains resulting from Self-Monitoring.

6. **Principle of continuity**. Self-monitoring system and program will be more efficient and better accepted, thus implemented if based upon already existing monitoring activities and organisation. Don't start from zero, use what exists.

7. **Principle of evolution and continual improvement.** The Self-monitoring system and the associated plan is maintained and kept up to date, following the changes in the environmental regulation, in the process itself or as the result of experience.

8. **Principle of information and awareness for all.** Information should also freely and fully circulate and be available to all within the company: upper manager, middle and lower management, workers and authorities. If necessary the company can organise two sets of information: a complete one, with absolutely ALL information available, for internal use; and one with information necessary to provide to the authorities, in compliance with requirement of applicable laws.

9. **Principle of co-operation with the authorities.** There should be an agreement between the facility and the authorities regarding the monitoring plan and particularly the measured parameters and used methods (in case there are no standard EEAA methods available) and a close co-operation based on mutual trust.

TOP MANAGEMENT COMMITMENT

Top-management commitment should be obtained at the early stages of planning the self-monitoring system. If top management is not committed, no body will. This commitment could be in the form of a written policy statement presented to the public by the Board of Directors, and signed by the Chief Executive Officer. The statement could present the general benefits of self-monitoring, and its usefulness in achieving environmental compliance.

1. ENVIRONMENTAL SELF-MONITORING (SM)

Self-Monitoring (SM) is a process that primarily relates to measurements of process inputs, releases and environmental pollution levels, as well as process conditions (operation controls) that are directly related to the monitored emissions. Self – monitoring is necessary for the plant to improve its economic performance by identifying the sources of wastes in raw materials, water, and energy that represent the main sources of pollution. Thus, the plant would be able to implement pollution prevention techniques that could reduce production costs and minimize compliance costs, which should lead to improved economic and environmental performance of the plant.

In addition, self-monitoring may include reporting of the results to the pertinent authorities. Monitoring can be carried out by the industrial establishment, or on its behalf, and paid for by the industrial establishment. The information obtained from the sampling component of the monitoring system must be recorded and the results reported to the appropriate internal and external decision-makers.

1.1 Benefits of SM

In general, the benefits of self-monitoring results to the operators include:

- Raising their awareness about the process performance and efficiency
- Having them ready for inspection by authorities.
- Providing inspectors with more reliable data to verify the single unrepresentative samples and/or measurements
- Raising their awareness about impact of pollutants
- Implementing corrective actions if non-compliance occurs.
- Deciding on raw materials, additives, fuels, and investment strategies.
- Identifying trends in plant performance and setting alarms.
- Improving process efficiency.

These benefits are generated through implementing an integrated environmental self-monitoring plan that comprises:

- Emission monitoring, which covers releases to air, wastewater, and solid and hazardous waste as well as regulated working conditions
- Monitoring of process parameters (operation controls) that are directly related to the releases; such as temperature, pressure, and humidity. In addition, process conditions such as shutdowns, maintenance operations, and spills need to be also monitored, linked to emissions, and reported.

1.2 Scope and Objectives of SM

As previously indicated, environmental self-monitoring comprises the monitoring of environmental releases (emissions) as well as the monitoring of process parameters (operation controls) that affect the environmental impact of the facility. The objectives of each type are separately detailed as follows:

a) Emissions self-monitoring

The basic objective of self-monitoring is to monitor compliance with environmental regulations. As the inventory for hazardous materials and wastes is mandatory with procedures for handling and storage as regulated by law 4/1994, self-monitoring should assist in covering this area. The objectives of emission monitoring may go beyond monitoring compliance; i.e. to assist improving environmental performance. In other words, monitoring of emissions at the process level is necessary to minimize emissions at the source through pollution abatement and prevention measures. While Egyptian regulations consider only concentration of the pollutants, self-monitoring may include pollution loads as well as the environmental impact on the receiving media. These data are required to assess the improvement of the environmental performance.

b) Process self-monitoring (operation control)

In most industrial facilities monitoring of process operations already exists. Some process operation controls should be monitored for improved environmental benefits. The main objectives of process self-monitoring (operation control) is:

- Optimization of process operation by controlling the operating conditions
- Minimization of losses
- Planned maintenance and repair as opposed to emergency maintenance and shutdown
- Minimization of cost through conservation of energy and water

1.3 SM and Environmental Management Systems (EMS)

Aside from the regulatory aspects, SM has shown to be a necessary tool for the plant to manage its releases, control its environmental impacts and improve its environmental performance. Such achievements represent the main objectives of the Environmental Management Systems (EMS), which in turn constitute a requirement for internal monitoring, checking and implementing the corrective actions. In addition, EMS encourages the industrial plants to adopt Cleaner Production, (CP), and Pollution Prevention, (P2), measures as the main tools for continual improvement. This can be achieved only by implementing a comprehensive and effective SM plan.

The following sections highlight the concept of EMS, link to SM and link between SM and cleaner production.

1.3.1 Environmental management systems (EMS)

An Environmental Management System (EMS) is a framework that helps a company to achieve its environmental goals through consistent control of its operations. The EMS itself does not dictate a level of environmental performance of the company; each company tailors its EMS to its specific business goals. Compliance with environmental laws and regulations has become a major goal that has to be attained with minimum cost. This is the minimum level for environmental performance to be achieved through the EMS. In general, an EMS comprises five phases leading to continual improvement; commitment and policy, planning, implementation, evaluation and review.

These phases will be herein explained within the context of the standard system “ISO 14000”, which is internationally recognized. With regard to Egypt, this system is being gradually implemented by the Egyptian Industry. The different stages of the EMS form a cycle (Figure 1) that allows feedback of information and continuous improvement. This system includes the following elements:

1. ***Environmental policy.*** Top management commits to an environmental policy that comprises, as a minimum, compliance with laws and regulations, pollution prevention and continual improvement. The policy is the foundation of the EMS

2. ***Planning***: The company first identifies environmental aspects of its activities. Environmental aspects are those items such as air pollutants or hazardous wastes that can have negative impacts on people and/or the environment. Once the pertinent laws and regulations are identified, the company sets objectives and targets. An objective is an overall environmental goal (e.g. minimize use of chemical x). A target is a detailed, quantified requirement that arises from the objective (e.g. reduce use of chemical ***x*** by 25% by September 2003). The final part of the planning stage is developing an action plan for meeting the targets, including schedule, resources, and the clearly defined steps to meet the targets.

3. ***Implementation.*** This phase comprises the establishment of the structure, assignments and responsibilities of the designated personnel. An important component is personnel training and awareness for all employees. Other steps in the implementation stage include documentation, document control, implementing operation procedure, and setting up internal and external communication lines. In addition, an emergency and preparedness plan has to be developed.

4. ***Checking and Corrective Action**.* The company monitors its operations and activities to ensure that targets are being met. If not, the company takes corrective action and keeps records for the emissions and environmental performance. Internal audit is a key element to improve the system.

5. ***Management Review.*** Top management regularly reviews the results of the evaluation to see if the EMS is efficient and effective. Management determines whether the original environmental policy is consistent with company values. The plan is then revised to optimize the effectiveness of the EMS. The review stage creates a feedback of information necessary for continuous improvement.

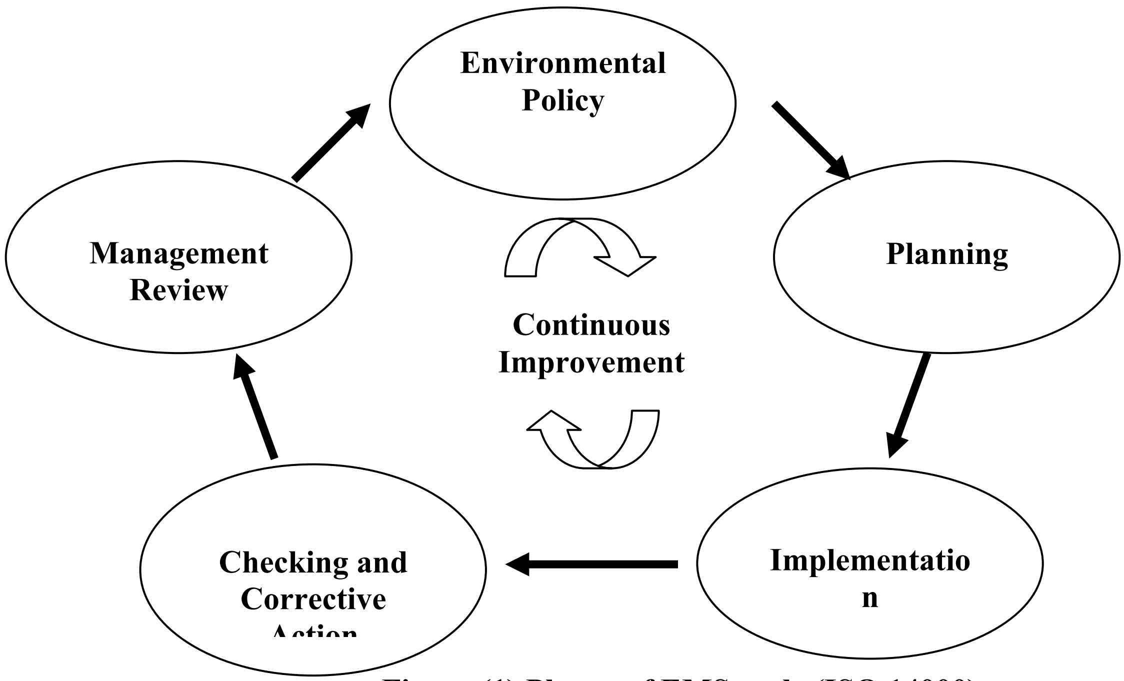


Figure (1) Phases of EMS cycle (ISO 14000)

1.3.2 Link between self-monitoring and (EMS)

As previously explained, an EMS e.g. ISO 14000, comprises 5 stages: environmental policy, planning, implementation, checking and corrective actions. By analogy, the self-monitoring system (SMS) can be looked at using the same concept. Taking into consideration the definition, concept and principles of self-monitoring, as stated in the "Guide Book on Self Monitoring", the elements of SMS can be rearranged as follows:

***Commitment*:** In general, an effective self-monitoring requires that the management of the plant be committed to environmental compliance, as a minimum. However, this commitment will be an integrated part of the environmental policy in the EMS, if exists.

Planning: The planning of the SM is mainly based on objective (s) that have been set. For a basic SMS, the objective would be monitoring of regulated parameters to assist in achieving regulatory compliance; e.g. end-of-pipe emissions and discharges. In an advanced SMS, the objectives may include monitoring of operation controls as well as emissions and wastes at the source, to help in implementing pollution prevention and cleaner production measures. In all cases, the objectives of self-monitoring should be in line with the objectives of EMS, if exists. In such case, the self-monitoring plan can be part of the EMS plan and includes:

- Description of the regulatory limits for compliance
- Brief description of the actual situation (existing monitoring activities, devices, equipment, resources,..).
- Objectives and targets with time frame for implementation.
- Identification of parameters monitored, location of monitoring points and preparation of a self-monitoring schedule.
- Description of methods and procedures used for sampling, analyses, measurements, calculations, recording and data manipulation.
- ` Description of tasks
- Training program

Implementation: The implementation of SM means that the tools and mechanisms for collecting the relevant data are functioning. On the other hand, the implementation phase in EMS means that the environmental performance of the plant is improving. The implementation of SM results in large amount of data that need representation, interpretation and reporting in order to be useful as tools for decision making for corrective actions. The decision making requires knowledge about the status of:

- Emissions as compared to limits set by law.
- Toxic and hazardous releases: concentration, handling procedures and transfers.
- Maintenance and repair.
- Percentage losses of raw materials, products and utilities.
- Process operating parameters.

Evaluation: Evaluation of the self-monitoring plan through regular auditing will allow its continuous improvement. Evaluation should include all aspects of the plan (training, meeting targets, reliability of data, efficiency of devices,…etc). On the other hand, the evaluation of the EMS involves checking and taking corrective actions of all system components, including the monitoring activities.

Review: On the basis of the evaluation of the monitoring plan, a review can be made of the monitoring objectives and targets. In case of EMS, the management review covers all the involved procedures, including monitoring activities.

It is clear from the above explanation that self-monitoring is an integral part of any EMS. More specifically, self-monitoring is the tool for the evaluation function of an EMS. Figure (2) illustrates relationship and interaction among the main elements of EMS and SMS.

1.3.3 SM Link to pollution prevention and cleaner production

Growing understanding that escaping raw materials, chemicals and products constitute major pollution sources, industry has opted to implement pollution prevention measures at the source. These measures include in-plant and in-process modifications as well as resource conservation (minimization of water and energy consumption). The implementation of these measures will decrease the end-of-pipe treatment cost. However, plant management will have to undertake a cost-benefit analysis to determine which measures are economically viable.

Self-monitoring is the tool that helps undertake these analyses by providing the necessary data and information about process inputs and outputs as well as the framework for performing the required tasks. The introduction of emission monitoring for the purpose of improved environmental performance through the application of cleaner technology widens the objectives of the plant EMS beyond compliance with relevant laws and should be met with economic incentives from the part of the competent authorities.

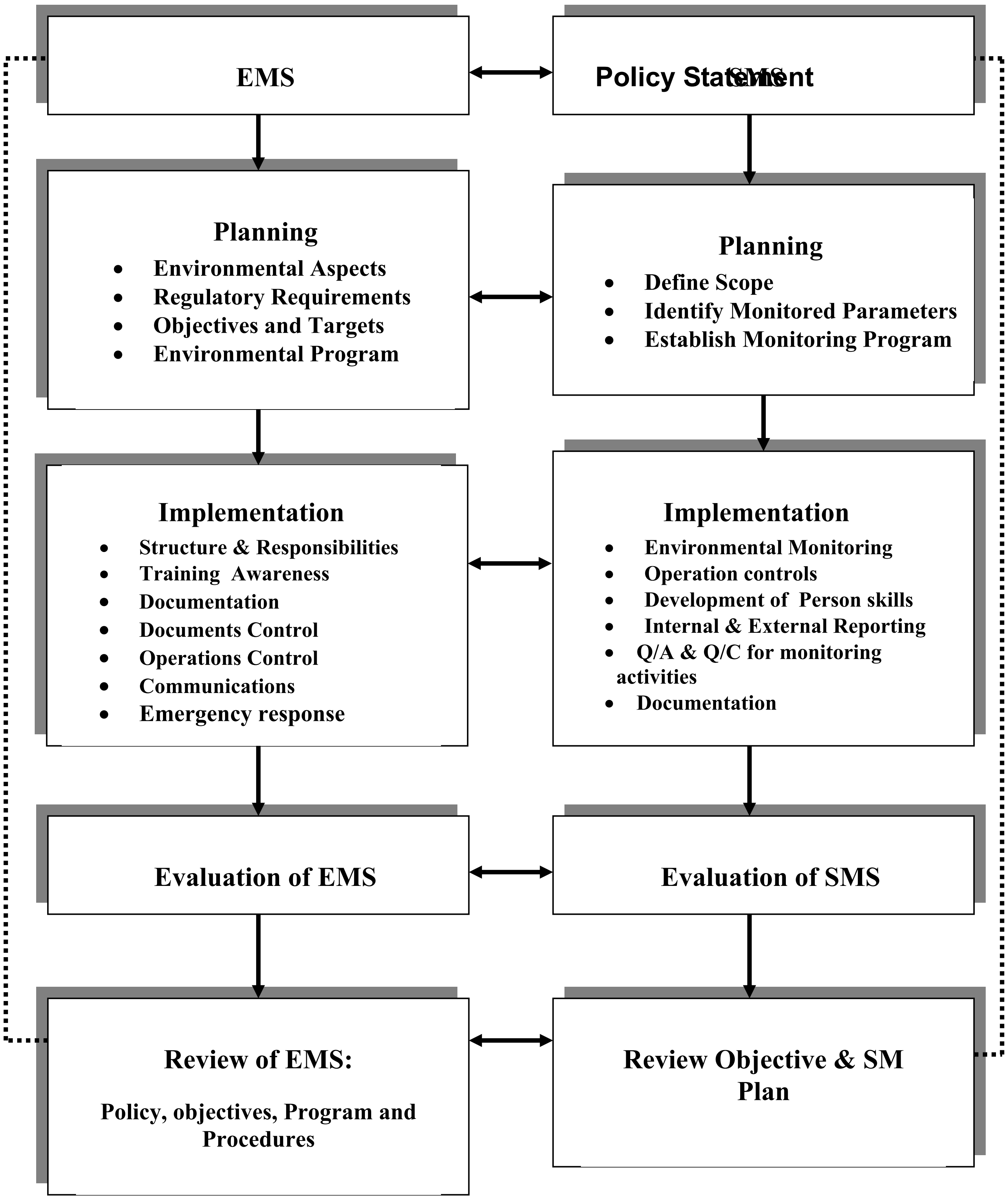


Figure 2 Relationship between EMS and SMS

1.4 Regulatory Aspects

In developed industrial countries, e.g. in Europe, the competent authorities must approve the monitoring program, specify the standards and quality requirements for self-monitoring that are to be achieved by the operator, and ensure those possibilities for cheating and fraud are minimized. The competent authorities will receive self-monitoring reports periodically from the operator. These should provide summary information, following data reduction, in a format facilitating easy comparison with permit limits. Additionally, the competent authorities would inspect the operator's self-monitoring records, including log sheets covering sampling, analyses, instrumental monitoring, and data-reduction calculations.

1.4.1 SM and Environmental Register

According to Law 4/1994, industrial facilities (operators) are required to keep a record of their inputs, outputs and releases in the environmental register as stated by which implicitly requires some sort of self-monitoring. The Egyptian Environmental Affairs Agency (EEAA) is mandated to check the validity of the data in the Environmental Register. The responsibilities of the operator and the competent authority are not affected by who carries out the monitoring. It is the responsibility of the operator to comply with laws and regulations. On the other hand, the competent authorities (inspectors) are responsible for assessing and ensuring the operator's compliance.

When combined with Self-monitoring, the Environmental Register can offer benefits to the ***competent authorities*** through:

- Utilizing the operator's knowledge and experience of his process in planning and carrying out a monitoring program that can lead to improved control over releases to the environment.

- Self-monitoring will normally provide more information than may be obtained by periodic inspection by the competent authorities.

- Providing a mechanism for educating the operator about the requirements for complying with relevant laws, regulations and permits and for increasing of management responsibility for compliance and the impact of process releases on the environment.

1.4.2 SM and Inspection

Self-monitoring does not constitute self-regulation. SM provides additional information on which the competent authorities can judge whether an operator is complying with relevant legislation and conditions of permits. It does not change the duty of the competent authority to assess compliance by means of inspection and by performing its own monitoring or choose to rely on the operator's monitoring data or a combination of both. The competent authority continues to be responsible for enforcement.

As mentioned above, SM provides a wealth of information that can be utilized by the competent authority in reviewing standards and developing applicable environmental policies. However, the competent authority will have to check the reliability of the SM data. Thus, inspectors may be required to check the SMS plan, QA/QC procedures, data handling and documentation. In this context, it is expected that inspectors may perform the following tasks:

- Check the SM program
- Check and verify the specified measurement standards
- Check the reliability of the data (by carrying out independent monitoring).
- Inspect SM arrangements such as:
  - The positioning and serviceability of fixed instrumentation.
  - Records confirming the maintenance and calibration of instrumentation and sampling equipment.
  - Manual sampling and analytical procedures.

This expected interaction would help both partners, i.e. the operator and the competent authority, in achieving their objectives in terms of reliability of emission data and environmental performance.

2. DEVELOPMENT OF SELF-MONITORING SYSTEM

The following sections present the planning stages for establishing a self-monitoring system; followed a summary of the major features of the organizational framework for the system.

2.1 Planning of Self-Monitoring

The following represents the main elements of the Self-Monitoring Plan that describes the SMS:

- Objectives and results required from the self-monitoring system
- Organization and share of responsibilities and tasks
- Planning activities and design of an implementation schedule
- Definition of the parameters and relevant monitored indicators to reach the objectives
- Design of an appropriate measurement and sampling program
- Data processing and reporting procedures
- System for follow-up of decisions, actions and monitoring development
- Quality assurance and control

The objective of the SMS can be limited to provide the data required for the Environmental Register, which is mandated by the Environmental Law, e.g. total inputs, outputs and emissions on the plant level. This objective compliance with regulations" requires the "Basic Self-Monitoring System" which comprises the minimum requirements. In these cases where self-monitoring is not mandatory, operator can build a "basic" self-monitoring system that focuses on the regulated emissions, as a minimum. Then, the system can be gradually upgraded, "continual improvement" through internal auditing of all system components.

Other objectives, e.g. waste minimization, pollution prevention and improved environmental performance require upgraded SMS that includes monitoring of inputs, outputs and releases on the level of operations and detailed processes. In all cases, the established SMS should be gradually improved and upgraded, considering the plant financial and economic constrains.

The following sections are detailing the stepwise activities that are needed to develop a viable, realistic, and applicable plan for a self-monitoring system. Figure (3) presents the various steps for the preparation and implementation of a self-monitoring plan.

2.1.1 Assessment of existing monitoring capacity

Assessment of existing monitoring capacity includes the following aspects:

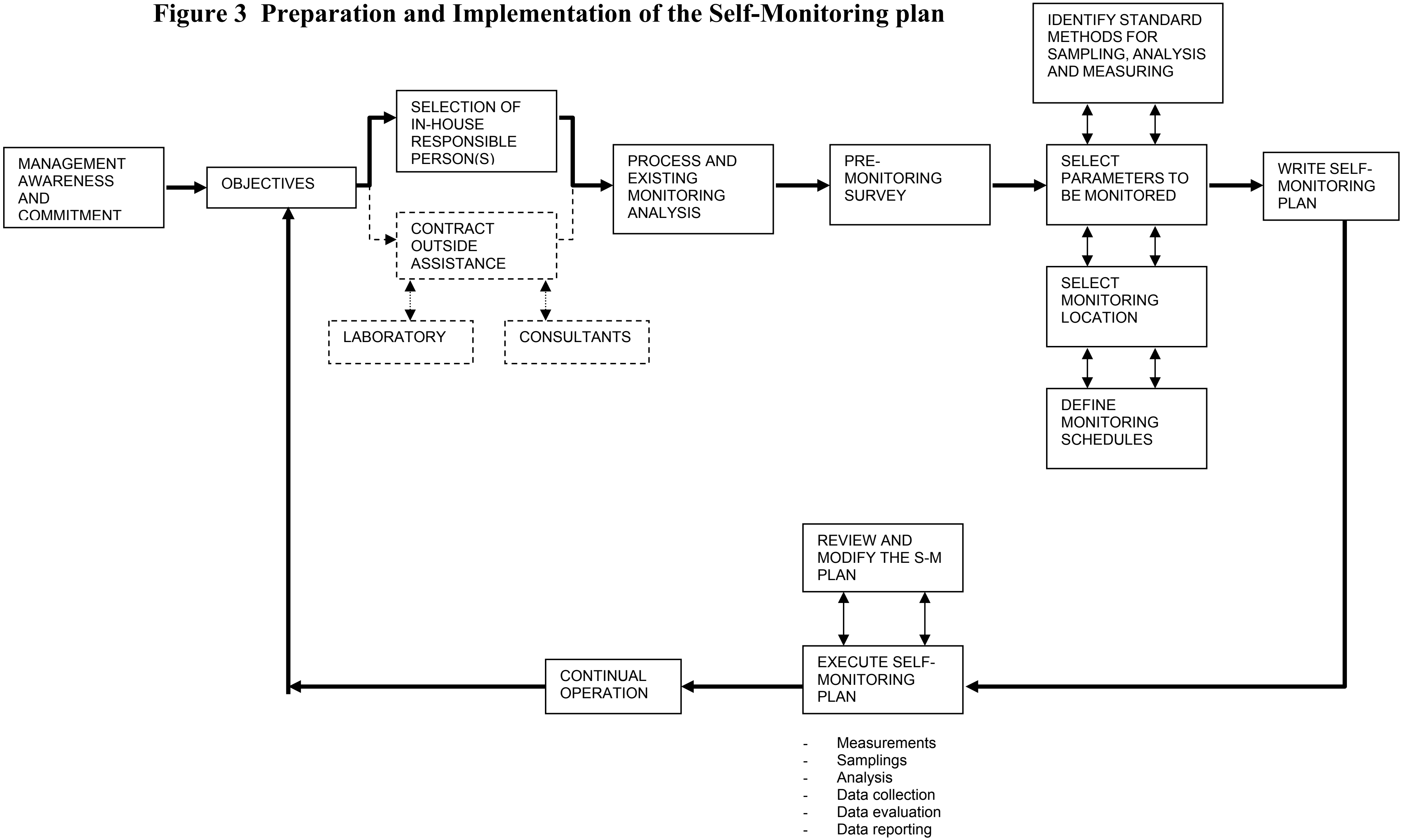
- Management system: presence of an EMS, existing system for data collection and reporting.
- Human resources: available personnel, level of training; motivation.
- Technical resources: monitoring equipment and laboratory, status of equipment
- Financial resources: available budget for self-monitoring activities.

Table (1) presents an example of a checklist for existing self-monitoring activities.

Table 1. Example for assessing the status of existing monitoring activity

Monitored activity	Location	Parameter	Associated tasks	Person in charge	Frequency
Wastewater	Final discharge	Flow rate	Recording flow on flow meter Inspect meter Calibrate Data analysis, representation	Operator X Supplier Operator Y Lab staff	Daily
		BOD, COD..	Grab sample Sample preservation Analysis Review results and reporting	Lab technician Lab staff Lab staff Chief of Lab	Once a week

Figure 3 Preparation and Implementation of the Self-Monitoring plan



2.1.2 Identification of objectives and scope

The objectives and expected benefits of the self-monitoring system should be clearly identified. In addition, objectives should be reasonable and achievable to ensure the success of the SM plan. These objectives could be modest, such as (achieving compliance), or ambitious, such as (saving money). When objectives are identified, the scope of the SM system could be also identified.

The scope should be identified according to certain set of criteria. The most important one is the main parameters that should be measured. The identification of key monitoring parameters requires an understanding of the manufacturing processes and the operation of the various units. However, a pre-monitoring audit is necessary to determine sampling and measurement locations and schedules needed to design the self-monitoring plan. Priority should be given to parameters that determine compliance with environmental laws. A table describing the monitoring activities can be prepared for process and compliance monitoring.

The exact positions of the monitoring points within the production line have to be determined on a case by case basis by production experts:

- Representativeness of the monitoring point.
- Criticality of the monitoring point
- Accessibility of the monitoring points

The choice of the parameters is determined by the type of production, the legal requirements, the nature of the pollutant and its load, and the importance of the parameter for decision making. For each of the proposed parameters the trends and variations should be monitored in addition to the value of the parameter at a given time.

2.2 Organizational framework

The development of the organizational framework is an essential step in the development of the SM plan. The organizational framework should clearly identify the following key elements:

- Human Resources; and
- Responsibilities and Tasks

Planning for each of these two elements is presented, as follows:

2.2.1 Human resources

In order to build the self-monitoring system supporting organisation it will be necessary to nominate persons for different positions in the organisation. The persons chosen to be part of the Self-Monitoring organisation must have the required competency, sufficient training, authority and budget according to the responsibilities and tasks associated to their positions. If necessary, the responsible person(s) should be further trained and budget should therefore be allocated for training. They must be committed, motivated and aware of their responsibility, task, position in the organisation, and related decision power (authority). Each person must have information about the responsibilities and tasks of the other persons involved in self-monitoring.

The main principle is the following: **Persons who have responsibilities for production and processes are also responsible for self-monitoring. The company can have specialists who assist in environmental issues**.

In the simplest case there may be only one responsible person – a sort of self-monitoring manager- assisted by 2 or 3 persons for the technical aspects. In most cases, for upper levels in the organisation, there may be only one person responsible for self-monitoring activities or a group or a committee

2.2.2 Responsibilities and tasks

Responsibilities of each person and associated tasks have to be clearly defined, at an early stage in the self-monitoring system-building process. Responsibilities should be shared and distributed within the organisation in order to cover all aspects of the self-monitoring, particularly:

1. Establishment and maintenance of the Self-Monitoring System
2. Follow up of all the evolutions of legal requirements
3. Follow up concerning relevant technical information and bench-marking data
4. Preparation of self-monitoring plan
5. Implementation of the self-monitoring plan
6. Training and awareness
7. Review, audits and continual improvement

The sharing of the responsibilities will be facility specific. The different responsibilities and associated task(s) should be described thoroughly in written documents. Table (2) is an example of document describing responsibilities, associated task and responsible persons.

Table 2: Self-monitoring responsibility description

Type of responsibility	Person(s) concerned	Specific Tasks
1. Establishment and maintenance of SMS		
1.1. Definition of the objectives and expectation of the self-monitoring system		
2. Establishment of external information collecting and updating system		
2.1. Review and follow up of all the evolutions of legal requirements		
2.2. Review and follow up concerning relevant technical information and benchmarking data		
2.3. Gathering information about standard analytical methods, field test, competent laboratories		
3. Review of present situation with regard to self-monitoring and baseline information		
3.1. Gathering and analysing all existing available data (internal data)		
3.2. Pre-monitoring survey: monitoring of all inputs, production control and operation and outputs (products, discharges). Determination of impacts		
3.3. Assessment of existing monitoring activities (organisation, technical aspects, results…)		
Type of responsibility	Person(s) concerned	Specific tasks
4. Planning activities		
4.1. Definition of the scope and level of self-monitoring		
4.2. Determination of the parameters to monitor, monitoring points and schedules		
4.3. Preparation of procedures and identification of analytical methods		
4.4. Assessment of equipment and training needs		
4.5. Investment assessment		
4.6. Preparation of the reporting schedule		
5. Implementation of the self-monitoring plan		
5.1. Monitoring of water, energy and utility use and management		
5.2. Monitoring of raw material (quality, quantity, losses)		
5.3. Process operation and safety monitoring and control		
5.3.1. On-line continuous control of process operations		
5.3.2. Monitoring of production (quality, amounts)		
5.4. Monitoring of emissions and operation of emission-control-systems		
5.4.1. Technical aspects (measuring, sampling…)		
5.4.2. Analysis of data, quality control and reporting		
5.5. Monitoring of wastewater discharges and treatment operation		

5.5.1. Technical aspects (measuring, sampling…)		
5.5.2. Analysis of data, quality control and reporting		
5.6. Waste management and waste recording		
5.7. Inspections and maintenance of equipment and measuring devices		
6. Control of the information, diffusion (reporting), and training		
6.1. Quality control and quality assurance for the self-monitoring data		
6.2. Compiling and analyses of all monitoring data		
6.3. Reporting (internal and external)		
6.4. Training		
6.4.1. Assessment of needs		
6.4.2. Organisation of training		
6.4.3. Follow up		
7. Review, audits and continual improvement		
7.1. Management review		
7.2. Review of results of implementation		
7.3. Analysis of problems met during implementation		
7.4. Follow up on decisions and actions taken		
7.5. Collection of feed-back information about monitoring and pollution (internal and external)		
7.6. Revision of the self-monitoring system and plan		

3. SELF-MONITORING METHODS

The choice of monitoring method used to determine the value of the parameter depends on the specific features of the process, the emission sources, the physical state and properties of the sample and the nature of emissions from the operation. The latter can be classified as:

Normal emissions	Occur during normal operation and normal process and abatement technique conditions .
Diffuse and fugitive emissions	These are emissions from a certain process but from scattered points such as emissions from ventilation ducts, barrels, scattered small storage's. The diffuse emissions are calculated/estimated by monitoring the source periodically and assessing the long term emission from the measurement results or by mass balance calculations.
Exceptional emissions	Exceptional emissions refer to varying input or process conditions, start-ups, shut-downs, by-pass of a process for malfunctioning and accidental causes. The emissions can differ from those of normal operation in their volume and/or concentration. These emissions can be multiple compared to normal emissions. It can be impossible to measure the concentration or volume of the exceptional emissions as the measuring device is calibrated according to the normal operating conditions. Estimation techniques should then be performed.

There are four basic methods that may be used to develop estimates:

- Direct or indirect measurement
- Mass balance
- Emission factors
- Engineering calculations

The following is a summary explaining each of these methods

3.1 Direct or Indirect Measurement

a) ***Direct measurements***: Using monitoring data or direct measurements is usually the best method for developing chemical release and/or other waste-management activity quality estimates. Data may have also been collected for the facility through an occupational health and safety assessment. If only a small of direct measurement data is available or if the monitoring data are not based on a representative sample, another estimation method should be used to give a more accurate result.

Note : Treatment Efficiencies
Supplier data on treatment efficiencies often represent ideal operating conditions, should be adjusted to account for downtime and process upsets during the year that would result in lower efficiencies. Efficiencies reported by supplier are often general and may not apply to specific chemicals. For example, an incinerator or flare may be 99.99% efficient in destroying organic chemicals, but will have 0% efficiency in destroying metals.

For successful measurements the following considerations should be satisfied:

- The frequency of measurement and sampling must cover temporal variations of the process and specifically the period during which harm occurs.
- Continuous monitoring is suitable for large emission sources, such as stacks and wastewater canals except in cases where high temperature or corrosive substances are involved. At smaller sites the cost of continuous monitoring is weighed against the value of the monitoring results and the possibility of obtaining representative results from periodic measurements.
- Utilization rate (percentage of continuous monitoring time to total operation time) should be known when performing continuous monitoring.
- The process conditions must be specified when monitoring takes place (e.g. start-up, shutdown, production rate, operating production lines, failure of abatement equipment).

b) ***Indirect measurements:*** These are performed through surrogate parameters.

Surrogate parameters are variables that can be closely related to conventional direct measurements of pollutant releases or impacts and which may therefore be monitored and used instead of direct values for some practical purposes. Surrogates are commonly used in operation control as they give an early warning of possible abnormal conditions or emissions. Surrogates may provide a relative measurement rather than an absolute value and may only be valid for a restricted range of process conditions. On the other hand, surrogates can provide more continuous information than direct measurements. It is also often cost-effective as it allows more discharge positions to be monitored for the same resources. A surrogate can be used for compliance monitoring purposes if it is:

- Closely and consistently related to a required direct value (e.g. fuel sulfur vs. directly measured SO_2, relationship between opacity and particulate concentration, condenser temperature and VOC emissions).

- Regularly calibrated against the direct value.
- Cheaper or easier to monitor than the direct value, or gives more frequent information
- Capable of being related to specific limits
- The process conditions where it is measured matches the conditions where direct measurements are required.
- Any extra uncertainty due to use of surrogate is not significant for regulatory decisions or process management.

The following table, Table (3), summarizes the advantages and disadvantages of surrogate parameters.

Table (3) Advantages and Disadvantages of Surrogate Parameters

Advantages	Disadvantages
- Cost savings - More continuous information e.g. continuous opacity vs. periodic dust sampling - Allow more positions for discharge monitoring - Sometimes more accurate e.g. fuel sulfur vs. SO_2 - Give early warning of possible abnormal emissions e.g. combustion temperature warns for increase in dioxin emissions. - Cause less disruption to process operation. - May combine information from several direct measurements e.g. temperature indicates energy efficiency, emissions and process control.	- Need cost for calibration against direct values. - May provide relative measurement rather than an absolute value. - May be valid only for a restricted range of process conditions. - May not command as much public confidence as direct values. - Sometimes less accurate.

3.2 Mass Balance

A mass balance involves determining the amount of chemical entering and leaving an operation. The mass balance is written as follows:

Input + Generation = Output + Consumption

- **Input** refers to the materials (chemicals) entering an operation. For example, chlorine added to process water as a disinfectant would be considered an input to the water treatment operation.

- **Generation** identifies those chemicals that are created during an operation. For example, when nitrogen sources are used in biological wastewater treatment systems, additional ammonia may be produced (generated).

- **Output** means any stream by which the chemical leaves the operation. Output may include on-site releases and other waste management activities to the environment, storage, or disposal; or the amount of chemical that leaves with the final products.

- **Consumption** refers to the amount of chemical that is converted to another substance during the operation (i.e., reacted). For example, phosphoric acid would be consumed by neutralization during wastewater treatment.

The mass balance technique may be used for manufactured, processed, or otherwise used substances. It is typically most useful for chemical that do not become part of the final product, such as catalysts, solvents, acids, and bases. For large inputs and outputs, a mass balance may not be the best estimation method, because slight uncertainties in mass calculations can yield significant errors in the release and other waste management estimates.

Material balance calculations are also used to examine the effects of emission reduction on the material balances of the plant. A material balance calculation gives an impression of the magnitude of the emission of a specific substance but cannot show accurate emission amounts, nor their division between emissions into the air, water discharges or solid wastes. Material balance calculations are often based on evaluated process flows and concentrations. Calculating of a reliable average emission level for a factory means long term monitoring of the processes and statistical examination.

3.3 Emission Factors

An emission factor is a representative value that attempts to relate the quantity of an emission released with an associated activity. These factors are usually expressed as the weight of released emission per a unit weight, volume, distance, or duration of the activity (e.g. kg of emission released per kg of product). Emission factors have been developed for many different industries and activities. Emission factors depend on the technology used, raw materials and pollution control devices. Emission factors can be obtained from industrial databases e.g. DSS (available at EEAA).

Note
Sources of information on emission factors should be carefully evaluated and the conditions for using the factors reviewed to determine if it is applicable to the situation at the facility.

3.4 Engineering Calculations

Engineering calculations are assumptions and/or judgments used to estimate quantities of listed chemicals released or managed. The quantities are estimated by using physical and chemical properties and relationships (e.g. Raoult's law, Ideal gas law) or by modifying an emission factor to reflect the chemical properties of the toxic chemical in question. Engineering calculations rely on the process parameters; thorough knowledge of the operation is required to complete these calculations.

Engineering calculations can also include computer models. Several computer models are available for estimating emissions from landfills, wastewater treatment, water treatment and other processes.

4. Monitoring of Raw Materials, Utilities and Products

Data of the inputs and outputs is needed for estimating the nature and amount of the releases when assessing the reliability of the monitoring results. The input data includes the quantity and quality of raw materials, chemicals, fuel and water used.

4.1 Raw Materials and Chemicals

The amount of fiber raw material and cost/ton are important monitoring parameters. Depending on the type of fiber raw material and chemicals, the quality is assessed by the relevant parameters and tests before acceptance, Table (4). In case of discharging chemical rejects to the sewer, the flow rate should be monitored to make sure that it does not cause an increase in pollutant concentrations in the final discharge beyond limits set by law.

Table 4 Monitoring of Raw Materials and Chemicals

Parameter	Monitoring Method	Indication
Amount of raw materials (milk) and chemicals (salt, preservatives,….etc) necessary to produce 1 ton of product	Weighting, measuring, book keeping and recording	Rationality in the use of raw materials
Quantity of rejected raw material (milk) per unit of product	Weighting, measuring, book keeping and recording	Losses, process efficiency, storing or handling problems
Quality of raw material	Specific criteria (density, fat content, etc)	- Avoiding possible production problems due to bad quality - Identifying raw materials(milk) harmful for the environment if discharges to the sewer it will lead to BOD increase
Cost of the raw material necessary to produce 1 ton of product	Book keeping	Assess economical burden due to non rational use of raw material and possible avoidable extra costs
Proportion of the cost of raw material in the cost of product & its variation	Book keeping	Assess economical burden due to non rational use of raw material

4.2 Utilities

Monitoring of energy consumption takes into account the different forms of energy. It is important to note that heat and electricity cannot be summed up, as they are not commensurate. The energy efficiencies of heat and electricity should therefore be dealt with separately. See Table (5).

Table 5 Monitoring of Utilities

Parameters	Monitoring Method	Indication
Energy consumption per ton produced • Electricity • Fuel	Consumption measurements and book keeping Fuel flow accumulator	Energy use efficiency
Repartition between the different types of energy used	Recording and book keeping	Energy use efficiency
Water consumption per ton of product produced per ton of production & and its variability	Flow measurements, book keeping and recording	Water use efficiency, most of the discharge related parameters are calculated
Quality of the utilities	According to the specific criteria	Impact on the smooth running and efficiency of processes
Steam : Pressure level Degree of saturation		
Process water : Pressure, temperature, quality		
Boiler water : Chemical quality		
Electric power : Voltage level		

4.3 Products

The most important parameters that need monitoring are presented in table (6).

Table (6) Monitoring of products

Parameters	Monitoring Method	Indication
Amount produced - Final product (pulp, paper, board, board products,...etc) - By- products (if exists)	Recording and book keeping	Production statistics
Rejects as a percentage of the total production, per unit of time - Final product (out of specification, expired date) - in- line rejects	Recording (quality control)	Production quality, avoidable expenses

5. OPERATION CONTROL

Processes should be operated at the optimum operating conditions to ensure the highest yield and productivity as well as product quality. Operation control deals with the control and monitoring of key parameters that affect environmental performance. These key parameters are monitored to minimize losses and therefore pollution. Planned maintenance is also important to minimize pollution and improve environmental performance.

5.1 Monitoring Control Process Parameters

Table (7) presents the major processes in each production line in the dairy industry and the parameters that should be monitored to minimize losses, maximizing productivity and predict maintenance needs in Pulp & Paper industry.

Table (7): Monitoring Operation Control Parameters in the Dairy Industry

Major Pollution Process	Cause of pollution	Affected media	Parameter monitored	Method Used	Indication	Person Responsible	Frequency/ Duration
Milk Production Line							
Milk Tank	Leak	Wastewater					Once a shift
			Milk level in tank	Level controller	Spills		
Pasteurization	High temperature, steam leaks	Work Environment	Temperature	Thermometer	Milk quality		Once every 3 months
Packaging	Water + Milk losses	Wastewater	Spills amount	Collect spill and weigh or measure amount	Lower productivity		Once a weak
White Cheese Production Line							
Ultra-filtration	Water + lactose	Wastewater	Temperature Weight or volume	Thermometer scale	Milk quality		Continuously
Curding	Cheese whey	Wastewater	Weight of milk or weight of cheese	Calculations	Cheese quality		Once a day
Roquefort Cheese Production Line							
Curding	Cheese whey	Wastewater	Weight of milk or weight of cheese	Calculations			Once a day
Incubation	Cooling water and/or refrigerant	Wastewater and/or Air Pollution	Temperature Incubation time	Thermometer Clock			Continuously
Refrigeration	Freon/ammonia leaks	Air Pollution	Pollutant concentration	Gas analyzer			
Mish Production Line							
Filtration	Cheese whey	Wastewater	Weight of white cheese	Calculations	Mish quality		Once a day
For All Units							
Equipment and floor washing	Detergents, oil and grease	Wastewater contain hazardous materials	Amounts	Book keeping	Effluent characteristics		Once a month

Table (7) Operation Control (continued)

Service units	Cause of pollution	Affected media	Parameter monitored	Indication	Method used	Person Responsible	Frequency /Duration
Boilers							
	Steam	Air	Pressure level Degree of saturation	Steam leaks Steam quality	Pressure controller		On-line
	Boiler flue gas	Air	Fuel to air ratio	Incomplete combustion (CO)	Gas analyzer		Every 6 months
	Boiler fuel (mazot)	Air	Sulfur content	SOx in flue gas	Gas analyzer		
	Boiler Feed Water	Water	Chemical quality	Scale formation	Analysis		Once a month
	Softener back wash	Water	Flowrate	Zeolite regeneration	Flow meter on wash water		
Refrigeration system							
	Freon or ammonia leaks	Workplace	Refrigerant pressure Pipe condition	Cooling temperature Product quality	Thermometer		On-line
	Cooling of compressors	Water	Oil in spent cooling water	Oily wastewater	Visual observation		Once a day
Cooling tower							
	Input water quality	Water	Temperature, dissolved solid	Scale formation	Analysis		Twice a month
	Output water		Temperature	Higher temperature	Temperature		
	Blowdown		Flowrate	Scale formation	Flowrate measurement		
Wastewater Treatment Plant							
	Flowrate higher than design value Pollutants concentration higher than design value	Receiving water body	Input flowrate and characteristics	Low efficiency	Analysis and measurements		Once a month

5.2 Planned Maintenance

Maintenance can be classified broadly into planned and emergency maintenance. Various types of planned activities (preventive, predictive) are undertaken with the basic objective of avoiding the need for emergency (breakdown) maintenance and the corresponding loss of plant profitability. The cost of an unscheduled breakdown resulting in loss of production can be substantial, and the cost of repairs may also be considerably higher than the cost of routine, planned maintenance of the equipment. A preventive maintenance program must include the following basic elements:

- Inventory of equipment with detailed design and operating parameters. The operating parameters are monitored as indicators for predictive maintenance.
- A record of failure rate and causes
- Evaluation of condition of equipment using the following criteria:
  - Maintenance cost per unit of product
  - Downtime due to maintenance
  - Percent of planned maintenance hours as compared with emergency maintenance
- Determination of corrective actions.

It is clear from the above paragraph that maintenance is a pollution prevention measure as it increases the efficiency of the unit, minimizes water consumption by preventing leaks, helps conserve energy through proper maintenance of electric and mechanical equipment as well as insulation of steam pipes. Table 10 includes examples of the parameters that can be monitored. The following are examples of typical maintenance procedures for some service units operated in chemical plants:

Compressors and refrigeration systems	Routine checking should include: • Testing for leaks • Checking refrigerant charge • Checking oil level and lubrication

Boilers, steam lines, heaters and dryers

There are many items to be checked to prevent explosion, such as checking operating procedures, detection of flame failure, and detection of unburned combustibles. With respect to energy conservation, the maintenance of steam traps, steam valves and insulation of steam lines is important. The following parameters should be monitored:

- Water level in the boiler
- Water quality to prevent the build up of scales that reduce heat transfer rates
- Temperature of metal, gas and water
- Pressure
- Fuel to air ratio
- Check the fuel supply for leaks
- Check air supply for leaks
- Check the flue gas temperature.

Table (8) presents a model for the relationship between monitoring and preventive maintenance.

Table (8) Monitoring and preventive maintenance

parameters	Monitoring method	Indication
Total number of shut downs and production interruptions	Recording	Overall assessment of the process reliability and avoided environmental loads
Number of equipment failures resulting in production shut down per type of process and type of equipment	Recording	Critical equipment
Process performance monitoring	Methods depending on the performance criteria	Process performance/ efficiency of equipment
Process equipment condition monitoring	Numerous methods, inspection, testing	Prevention of failures

6. ENVIRONMENTAL MONITORING

Environmental monitoring covers emissions to air, effluents and solid and hazardous waste. Annex (C) presents the various laws and regulations that apply to emissions, effluents and wastes from the Egyptian industry. Table (9) presents the compliance monitoring activities for the different aspects of pollution from the Pulp and Paper industry as per environmental laws. The output from the measurements and analysis of the parameters are recorded in the environmental register of the facility.

Monitoring of pollutants and releases requires careful consideration of the techniques being used because due to the expected effect on the interpretation and hence, the reliability of the collected data. The common techniques used in environmental monitoring will be explained in the next sections.

6.1 Emissions to Air

Air emissions can be measured either on periodical or continuous basis.

Periodical measurements: Periodical measurements give the state of emissions over the chosen sampling time. Quantities needed in every emission calculation, such as volume flow, oxygen content and humidity of the fume, are determined by periodical measurements. Periodical measurement results are also used as a support for converting the continuous concentration measurement results into annual emissions.

Periodical measurements are carried out as manual single measurements or as short period continuous measurements by the plant itself or by an external measurer. Periodical emission measurements are carried out annually for the following emission components: NOx, SO_2, TRS, CO, CO_2, Cl and particles, in some cases also for dioxins, HCl and furan emissions from sludge burning boilers.

Continuous measurements: The continuous measurements describe the temporal variations of the concentrations of the emission components during the operation. General requirements for continuous monitoring systems are that the sampling places should be representative and that the monitoring equipment should be suitable for the concentrations to be monitored and for the prevailing circumstances. The emission control data system should preferably be part of the process control system.

Sulfur dioxides, TRS, particles, carbon oxide are generally measured continuously.

Emission calculation: Differences between the calculational methods can cause mistakes when comparing the environmental loads of different plants. Material balance calculations are used to complete emission measurements in order to get an impression of the reliability of the measurement results as well as to create a general view of the total emission level of each component. The amount of diffuse emissions that cannot be recorded by emission measurements can be substantial.

6.2 Effluents (wastewater)

The regulations state the limits for the concentrations of some specific pollutants of the wastewater when discharged to the recipient body. For monitoring purposes, the discharge values for specific substances or parameters are mostly expressed as total amounts per unit time. In some cases these values are given as specific amounts per ton of product or as purification efficiencies. Limit values are set for COD/BOD5, AOX, TSS, phosphorus and in some cases also for nitrogen.

Monitored control parameters: Typical wastewater control parameters include the following:

- Waste water flow (Q), m^3/d
- Total suspended solids (TSS), mg/l
- Temperature, °C
- Chemical oxygen demand (CODCr), mg O_2/l
- Biochemical oxygen demand (BOD7), mg O_2/l
- Total nitrogen (N), mg/l
- pH
- Conductivity, mS/m

Flow measurement: Measuring of the total waste water flow is required for the operation of the wastewater treatment plant. There have been no provisions on the procedure or the accuracy of a flow measurement, but installation of automatic composite samplers (preferable flow dependent) can be used. Wastewater flow is usually measured with a venturi measurement equipment, but also magnetic and ultrasonic methods are used. Measurement equipment is maintained several times a year and the measurement system is calibrated regularly.

Regular maintenance, control and calibration are needed to obtain an acceptable measurement accuracy level. Structure of the measurement system, a possible mounting fault or a false choice for measurement area could cause errors. Other sources of error or factors disturbing the measurement are dirtying and temperature variations of the measuring equipment. Evaluation of the total error is extremely difficult, as it must include all these factors.

Sampling: Well realized sampling is essential for determination of wastewater discharges. There are general instructions for wastewater sampling. However, the specific problems of pulp and paper waste water sampling, caused by the variation of the wastewater quality have to be solved case-by-case, considering the operational reasons. Samples are either single grap samples, composite samples, or composite samples in proportion to the flow. A single grap sample reveals the composition of the wastewater at the sampling time. With several single samples it is possible to follow the waste water load peaks, quality variation and the easily variable parameters. A composite sample reveals the average composition over a chosen period. A 24 hour composite sample is normally taken in proportion to the flow so that the sampler is controlled by a flow meter.

Table 9a. Compliance Monitoring for Air pollution, Pulp & Paper Industry

Major pollution sources	Impact	Parameter monitored	Method used	Source type	Operating Conditions	Pollution control devices
				- Point - Diffuse	- Normal - Exceptional	
Kraft Pulping Processes						
Chemical recovery - Evaporators - Recovery boiler - Lime Kiln	Air	SOx NOx HC Particulates	Gas analyzer			Scrubber Electrostatic precipitator
Energy generation	Air	SOx NOx HC CO Particulates	Gas analyzer			
Waste Paper Processing						
Energy generation	Air	SOx NOx HC CO Particulates	Gas analyzer			
Paper/Paperboard Production						
Energy generation	Air	SOx NOx HC CO	Gas analyzer			

Major pollution sources	Impact	Parameter monitored	Method used	Source type	Operating Conditions	Pollution control devices
				- Point - Diffuse	- Normal - Exceptional	
		Particulates				

Table 9. b. Compliance Monitoring for Wastewater and Solid Waste

Major Pollution Sources	Impact	Parameter monitored	Method used	Source type	Operating Conditions	Remarks
				Point Diffuse	-Normal -Exceptional	
Kraft Pulping Processes						
Sources of wastewater: Pulping Washing/Screening Bleaching Chemical recovery	Receiving water body	- Organic substances (COD, BOD): - Extractives compounds like resin acids, etc.[1] - chlorinated organics (AOX), chlorate: - nitrogen, phosphorus: - suspended solids: - metals, salts: - colored substances:	Analysis			- Raw material preparation: no direct release but there is the potential for run-off of washing water. - Chemical recovery: wastewater mainly contains the organic in condensates - Bleaching: wastewater mainly contains the substances dissolved during bleaching and the residues of the bleaching chemicals.
Sources of solid waste: Raw material preparation Chemical recovery	Landfill	– boiler ashes – dregs, lime mud – sand and stones – green liquor sludge	Mass balance			Raw material preparation: dust, ashes and rejects. *Chemical recovery*: inorganic sludge (dregs and lime mud)

[1]Exclude in case of bagasse and straw.

Major Pollution Sources	Impact	Parameter monitored	Method used	Source type	Operating Conditions	Remarks
				Point Diffuse	-Normal -Exceptional	
Water treatment		– Raw fiber material waste – primary and bio-sludge – cleaning and mixed household type waste – others				<u>Water treatment:</u> inorganic material, fibers and biological sludge <u>Boilers:</u> dust
Waste Paper Processing						
Sources of wastewater Screening/ cleaning Washing, thickening and sludge handling Excess white water De-inking	Receiving water body	- Organic substances (COD, BOD) - chlorinated organics (AOX)[2] - nitrogen, phosphorus - suspended solids - salts - colored substances	Analysis			- Water from the papermaking machine is recycled to the de-inking process. - Whit water is recycled in the stock preparation. - Water from save-all and floatation cell is recycled to re-pulping process.
Sources of solid waste: Waste paper preparation De-inking Water treatment	Landfill	Sludge from raw water treatment - primary sludge: fibers, fillers, coating pigments - bio-sludge - rejects, de-inking sludge - ashes from steam/power generation - sludge from chemical waste water treatment				- Waste paper preparation: dust, ashes and rejects. - Water treatment (inorganic material, fibers and biological sludge) - Boilers: dust
Paper/Paperboard Production						
Sources of wastewater	Receiving water body	- Organic substances (COD, BOD) - chlorinated organics (AOX)[3]	Analysis			Biodegradable organics. non-biodegradable organics

[2]Only in case of waste paper de-inking and bleaching with hypochlorite or Cl_2

[3]Exclude in case of unbleached waste paper.

Major Pollution Sources	**Impact**	**Parameter monitored**	**Method used**	**Source type**	**Operating Conditions**	**Remarks**
				Point Diffuse	-Normal -Exceptional	
- Overflow from the main papermaking circuit - Press section - Overflows from tanks with poor level control - Wastewater from chemical cleaning of machine. - Washouts from chemical preparation equipment.		nitrogen, phosphorus suspended solids - salts - colored substances				Very low levels of heavy metals such as cadmium and mercury. Adsorbed on particulate solids.
Sources of solid waste Finishing operations		- Industrial wastes: - Not recycled broke:				- Industrial wastes, e.g. baling wires, packaging, redundant equipment, scrap materials - Not recycled broke due to colors or specialist fibers.

9.C Monitoring of the Status of Work Environment

Major pollution sources	Impact	Parameter monitored	Operating	
			Normal	Exceptional
Kraft Pulping Processes				
Air pollution Potential locations: Raw material preparation Pulping Washing/Screening Bleaching Chemical recovery	Work environment	Air pollutants (according to used chemicals)		
Noise Potential location: Raw fiber material preparation				
Waste Paper Processing				
Air Pollution Potential locations: - Re-pulping - Bleaching - De-inking				
Noise Potential location: In the neighborhood of paper machine				
Paper/Paperboard Production				
Air pollution Potential locations: Finishing operations				
Noise Potential location: Raw fiber material preparation				

Sampling period and sample size are considered case-by-case depending on the analyses used and on the issues affecting the reliability of sampling and analyses. Samples for wastewater analysis are mostly taken over 24 hours, 5-7 days a week. In some cases samples are frozen and combined to cover a longer period. Samples for COD and suspended solids determination are taken daily or continuously and analyzed daily. Samples for BOD and nutrient determination are usually taken weekly. pH and conductivity are usually measured continuously.

Analyses: A specific analysis programe may be needed for each mill. The programme usually covers a wide range of measurements and analyses, as predetermined in the self-monitoring plan. The measurements and analyses should be carried out according to the standards recommended by the authorities.

Calculation: Wastewater discharges are calculated and reported according to the specifications determined in the monitoring plan. Discharges are often calculated as below:

Discharge per day	The arithmetic mean value of the daily samples taken during one month divided by the number of sampling days
Discharge per month	Daily discharge multiplied by calendar days
Discharge per year	Sum of the values of monthly discharges

The efficiency of biological waste water treatment is also controlled by calculating the reduction of organic matter (BOD5, COD) between untreated wastewater before primary sedimentation and treated wastewater after secondary clarification.
A typical wastewater discharge monitoring report includes e.g. monthly mean values and variations for discharges in the points of monitoring before and after the treatment, limits values in force and also some production information.

6.3 Solid Wastes

The properties of solid wastes that are generated, especially when they are utilized or taken to a landfill, have to be investigated. The general principles in landfill operation are that the composition, leachability and long term behaviour and the properties of the waste have to be known. The approval of the landfilling of a waste for a certain landfill category is based on the origin and the properties of the waste. The evaluation of the properties of the waste is based on:

- the composition of the waste,
- the organic content and degradation properties of the waste,
- the content and leachability of harmful compounds, and
- the ecotoxicological effects of the waste and the landfill waters from the waste.

7. DATA COLLECTION, PROCESSING AND USAGE

The general objective for the self-monitoring system is to produce data that is representative, repeatable, reliable, compatible and comparable. These characteristics is dependent on the applied measures for quality control and quality assurance throughout the data production chain i.e. volume determination, sampling, sample pretreatment, treatment and analysis, data processing and reporting, See Annex (A).

7.1 Data Collection and Processing

The various parts of the monitoring system of a plant include diverse factors affecting the reliability and comparability of the emission data. These factors have to be taken into consideration in sampling, sample treatment and analysis as well as in processing and reporting of the data. Requirements for the whole data production chain should be set in the monitoring program. In addition, implementation of the relevant measures for quality control and quality assurance is extremely important in obtaining maximum reliability, repeatability and comparability.

The aspects and parameters that are involved in data collection and processing are explained in the ***Appendix A***. Figure (4) shows the main aspects and parameters that affect the effectiveness of SM in terms of reliability, repeatability and comparability.

7.2 Using SM outputs

The implementation of the self-monitoring plan will basically result in three outputs:

- Data and information about the facility
- Preparing the environmental register as required by law.
- Reports describing results of the self-monitoring and problems faced during implementation
- Feed back and decision making

7.2.1 Techniques for summarizing and illustrating data

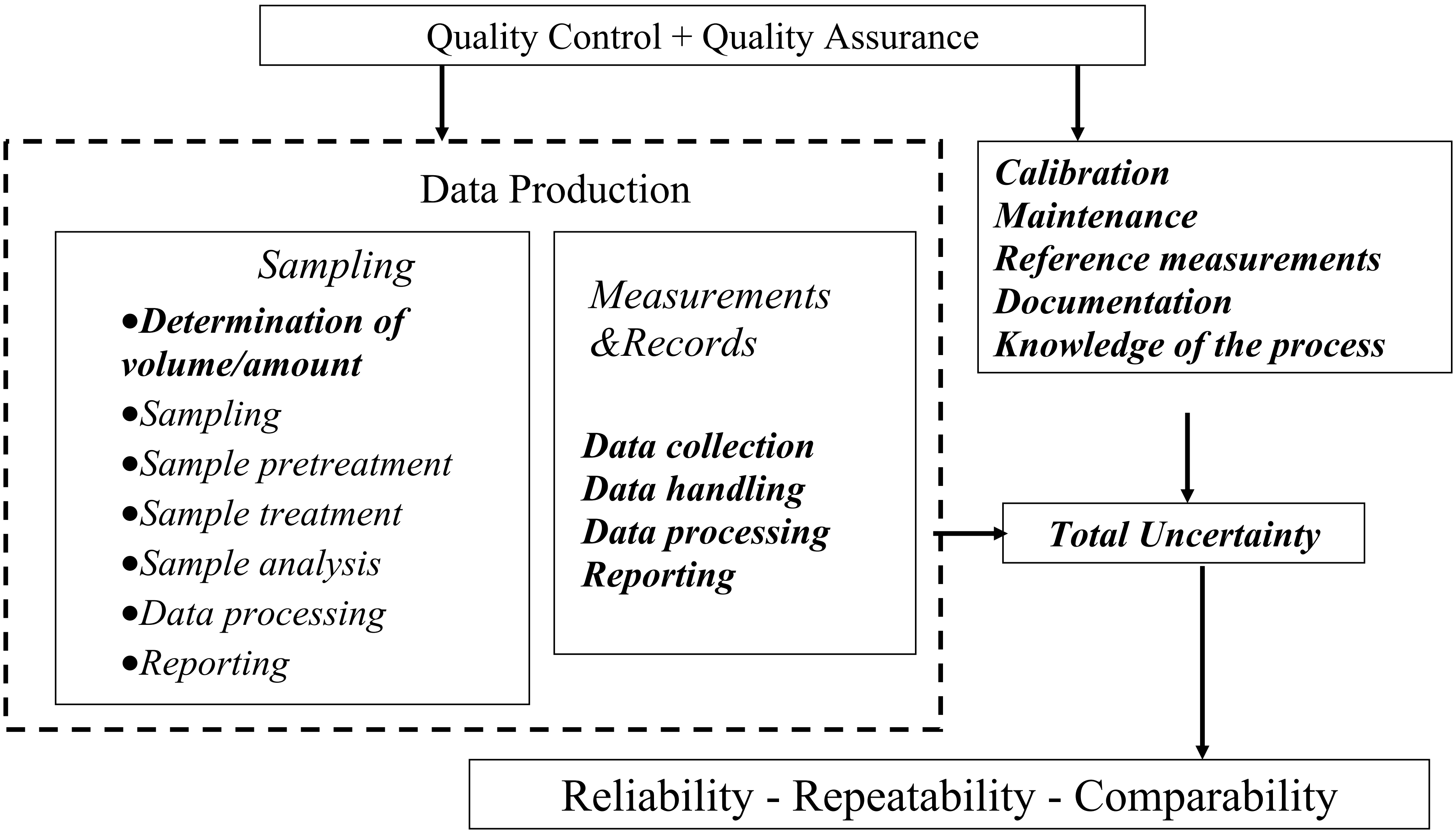
It is best practice to record process and environmental information in a detailed archive or database. It can then be related easily to the monitoring results and used to evaluate, compare and manage aspects of process performance such as:

- the rate of release of pollutants compared to production
- the rate of generation of waste compared to production
- the rate of consumption of energy and/or materials compared to production
- the impacts on environmental receptors compared to production or to their sensitivity

- the overall resource efficiency of the process, i.e. production compared to inputs or raw materials and energy, and outputs of pollutants and waste

There are many techniques used in the interpretation of results (e.g. statistical analysis of the measurement results, reduction of operating conditions to normal conditions when monitoring gaseous emissions).

Figure (4) Parameters Affecting SM Reliability



7.2.2 Environmental register

Only monitoring data related to compliance will be included in the environmental register. Description of the measuring and/or analytical techniques used should be reported as well as the location of sampling and measuring. EEAA/EPAP prepared a detailed description of the Environmental Register, based on the requirements of Law 4/1994, see ***Annex B*****.** The competent authorities could request the inspection of the measuring devices to check their operability and the maintenance record for these devices. The procedures for taking samples could also be checked by the inspector. The inspectors check whether the facility has provided information that is relevant and of sufficient quality. To assess compliance, a simple numerical or statistical comparison between the measurements, their uncertainty and the limit value is performed. According to Law 4/1994, compliance self-monitoring data should be recorded and kept for a minimum of 10 years.

7.2.3 Reporting

Description of the reporting scheme, its content, recipient and purpose should be included in the self-monitoring plan. A monitoring report is a uniform presentation of data over a fixed period. An annual monitoring report that provides information of the past calendar year is always required. Shorter period reports are required for significant polluters. The conditions of the process and equipment as well as location of monitoring points should be specified. Reporting can be:

- **Internal** to inform the Management and raise the environmental awareness of the facility personnel. It should include problems met during the implementation of the SM plan to be used in decision making.

- **External** for the competent authority. Based on the environmental register, establishments are required to report on environmental violations.

7.2.4 Internal auditing and conclusions on results

The data obtained must be compared regularly with the objectives written down in the monitoring program to check that they are being met.

7.2.5 Feedback and decision making

Feedback on the assessment of compliance based on the monitoring results should include all parties involved with the monitoring activities. The participants should make the necessary improvements and corrections to the next monitoring program.

In those parts of the monitoring program where compliance is met, possible reduction in frequency of monitoring can be considered and instead move resources to parts that need more accurate monitoring, e.g. borderline or non-compliance situations. Feedback should include all parts of the monitoring program, process, product control, maintenance, environmental management and occupational safety. Detailed requirements should be set for the improvements needed and a date fixed for their implementation.

7.2.6 Using outputs in public relations

The monitoring data is refined and distributed to the end users such as national and international reporting, research and statistical purposes, citizens, and the media.

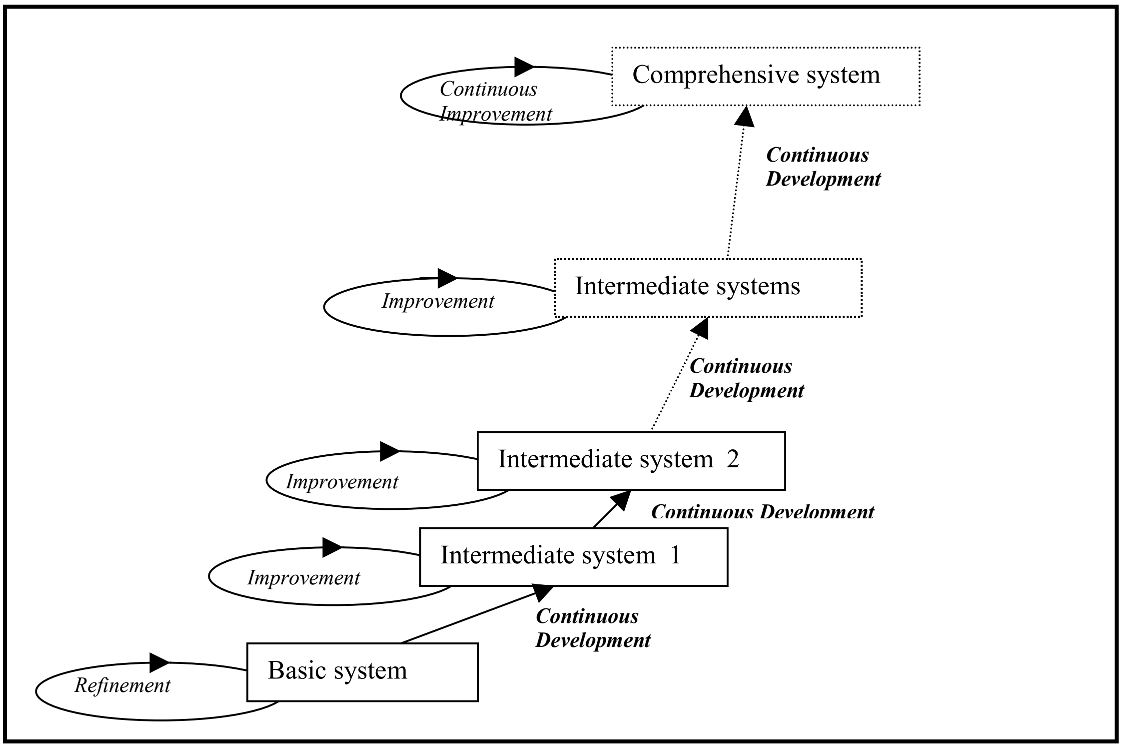
The citizens have the right to present complaints about the health or environmental impacts caused by the operation these complaints are directed to the permitting and supervising authority.

Monitoring data is needed e.g. in national research and statistics, for planning and evaluation purposes, by national group organizations and the media.

8. IMPROVING SELF-MONITORING SYSTEM

An advanced and efficient monitoring system should be the final objective of any industrial facility in Egypt, because it brings full benefits to the facility and the environment. However, the Egyptian reality is that many companies will have to build their self-monitoring systems step by step, starting from the adequate level based on their resources. This should be done without entailing too much investment and it should meet the objective of compliance and provision of an environmental register to the authorities, as required by law. The monitoring system may be continually developed and improved (figure 5).

Figure (5): The successive developments of a basic self-monitoring system into a continually improved advanced self-monitoring system.



A self-monitoring system may develop in various ways and directions: for example its scope, coverage, objectives, diffusion, organisation may expand and develop, continuously or by steps. The development of the self-monitoring system is however depending on facility specific decisions and there cannot be only one way. Each step of the development may contain a continual improvement process insuring optimum efficiency and quality of the self-monitoring. The development of the self-monitoring is necessary to obtain more data that can be used to:

- identify processes and other sources of major contribution to pollution loads,
- achieve actual improvement of the whole management of the production process and run the process more smoothly,
- improve maintenance planning,
- pinpoint and prioritise the actions and related investments,
- improve environmental performance in a cost-effective way.

Comparison table between a minimum and an advanced self-monitoring system

Comparing a minimum and an advanced self-monitoring system is necessary to highlight the directions in which a self-monitoring system may develop and evolve. The following is a general table, Table (10), of comparison between a minimum self-monitoring system and an advanced one.

Table (10): Comparison between a minimum self-monitoring system and an advanced one.

Element considered	**Minimum self-monitoring system**	**Advanced self-monitoring system**
Objective	Compliance and environmental register	Improved environmental performance, waste reduction, prevention and improved process management
Organisation	1 responsible person, eventually 2-3 persons for technical matters	Full organisation involving all levels and all the facility's structure. Network.
Responsibilities	Upper management is responsible	Responsibility is shared at all levels of the organisation and goes "down" (delegation)
Scope of the self-monitoring	Limited to environmental self-monitoring	All encompassing: process operation monitoring and environmental monitoring with inside-process monitoring
Planning activities: Number of parameters monitored Number of monitoring sites and monitored processes Schedule and frequency of monitoring	 Limited Limited, end-of-pipe and most important pollution sources Minimum	 Several All processes and inside the processes Increased frequency and tighter schedule. Continuous monitoring
Technical responsibilities: Sampling and field measurements Analysis of samples Calibration, inspection and maintenance of monitoring equipment	 External laboratory's staff and/or own staff, well trained External competent laboratory or company's own competent laboratory External or internal for own equipment	 Own staff, well trained Facility's own or external competent laboratory Internal and for special tasks, external
Monitoring equipment	Rented or owned	Mainly owned

Table (10): Comparison between a minimum self-monitoring system and an advanced one (continued).

Element considered	Minimum self-monitoring system	Advanced self-monitoring system
Information management (information collection, treatment and recording)	Concerns legal requirements	Concerns legal requirements, technical information, old monitoring records and results, information concerning problems met
Data analysis and interpretation of the results	Essentially comparison with legal requirements. Determination of compliance or non-compliance	Analysis of variations and trends (statistical analysis), analysis of past records, comparison with regulation, benchmarking, prioritisation and problems
Training and communication	Limited to some persons	Tailored for specific needs. Concerns the whole staff with information concerning self-monitoring activities and aimed at raising awareness and involvement
Reporting	Limited number of reports and limited diffusion: top management and authorities. Demonstrating compliance	Large diffusion both inside the facility and externally with information and communication to all stakeholders and customers. Building of an image for the facility.
Audit and review	Small scale, not during star-up	External inspection and audits, regular, according to an auditing plan

Benefits of a more advanced self-monitoring system

Some of the potential benefits may be summarised as follows:

Table (11): Potential benefits of a more advanced Self-Monitoring System.

Monitoring of:	**Leads to : 1) Potential immediate benefit**	**2)Potential ultimate benefit**
Raw material consumption	rationalisation of their use. increased productivity	Savings
Raw material quality	More smooth process operation and increased product quality. Eventually reduction in emissions (example: monitoring of sulphur contents in fuels). Increased productivity Reduction of costly shut-downs	Savings , economic benefits and environmental benefits
Water consumption	Rationalisation of use, loss reduction	Savings
Energy consumption	Rationalisation of use, loss reduction	Savings
Discharges and emissions from various processes and inside processes	Determination of sources of pollution, help in pollution prevention and reduction process. Prioritisation of investments and help in decision making. Help in maintenance planning	Economic benefits, rational investments and savings. Environmental benefits
Product quality monitoring	Better running of the process and increased product quality	Savings, increased competitiveness and advantage on the market
Process operation	Improved process management and process efficiency. Help in maintenance planning	Savings

The following three sections present a summary for the activities and tasks required to be performed in order to develop a more advanced SM system. It includes internal review, assessment of the system effectiveness, and areas for improvement. It is clear that the three areas are interconnected; since internal reviewing will lead to assessing its effectiveness, hence highlighting its shortcomings and the clearly pinpointing areas for improvement.

8.1 Internal Auditing

The continual improvement of the self-monitoring system is a key principle, whatever the self-monitoring level considered.The organisation will periodically review and evaluate its self-monitoring system in order to identify opportunities for improvement and their implementation. Improvements in the self-monitoring system are intended to result in additional improvement in the data collected, and hence increased benefits. The audit is the key-tool in the continual improvement process and it should be performed on regular basis.

8.1.1 Audit objectives

The audit should be a systematic, documented verification process of obtaining and evaluating audit evidence to determine whether the self-monitoring system meets the objectives and whether it could and should be improved and where.

The objectives of the audit will therefore be:

- to determine if the self-monitoring system meets the objectives it was built for,
- to check whether the people are aware of their responsibilities and the associated tasks
- to determine whether the self-monitoring plan has been properly implemented
- to identify all problems
- to identify areas of potential improvement
- to check the facility's capacity for self-monitoring

8.1.2 General principles for auditing

- Availability of data and information for auditors
- The scope and objective of the auditing process should beclearly identified and reported to the top management.
- The objectivity and the independence of the auditor should be stressed. In case there cannot be any unbiased and independent person found from the in-house staff the facility will have to turn to external consultants.
- The auditor should work with professional care and accuracy and follow clearly defined procedures.
- Reporting of the audit results to the top management of the facility in order to put the audit recommendations through the decision-making process.

8.1.3 Subjects of the self-monitoring audit:

The following aspects are the subjects to the auditing process:

- Self-monitoring policy
- Self-monitoring plan
- Organisational structure, responsibilities, tasks, authorities
- External and internal communication, and information flow
- Procedures and instructions
- Training
- Measurements, analyses and recording
- Data analysis

- Corrective actions and decision-making mechanism

8.2 Effectiveness of the Self-Monitoring System

The management should examine how the self-monitoring system is functioning within the facility. This examination should include:

- Accuracy and availability of records and measuring reports
- Handling and execution of procedures
- Ability of the system to achieve the stated objectives
- Quality Assurance, Quality Control procedures

8.3 Areas for Improving the SM System

The following is a brief description of the steps and stages for the development of the self-monitoring system. Since each establishment has its own starting point, therefore the required development steps will be decided by the establishment itself, depending also on its priorities.

8.3.1 Development steps

The following are some examples of suggested steps of development of the basic self-monitoring system. It should be kept in mind that because the starting level for self-monitoring is company specific, the steps to take to develop the system will also necessarily be company specific and will depend on the gaps existing between the start/actual level and the planned-next level.

Revision of the Objectives

The organisation should set more ambitious objectives for the advanced self-monitoring system. The objective could, for example, be to go toward an integrated system for environmental compliance, process management and environmental management.

Technical Developments

The development of the self-monitoring system implies the extension of the scope and probably monitoring of more parameters, with more sampling points, and therefore technical development and investments. The following present some suggestions of steps to take:

- Extend step by step the monitoring.
- Modify monitoring schedules, monitoring points and eventually monitored parameters, when necessary.
- Develop in-house know-how for sampling and use of automatic pollutant analysers and meters if deemed relevant.

Development of Data and Information Management

When the self-monitoring system develops the amount of baseline information needed for planning activities and the quantity of information collected as a result of self-monitoring will increase dramatically. Therefore it would be very important for the company to develop the data and information management systems. The following are examples of steps to take and aspects to develop:

- Use of data as decision-making tools and study trends.
- Recording systems for various data.
- System and procedures to keep up-to-date the information concerning legislative requirements.
- System and procedures to collect and keep up-to-date relevant technical information and benchmarking data.

Financial Aspects

The developments concerning financial aspects are important for the following reasons:

1. Savings and resources resulting from self-monitoring activities should be clearly assessed and pinpointed. This way the economic benefits of self-monitoring will be clear for all and justify present and future activities, and investments.
2. Further investments needed for the development of the self-monitoring system have to be assessed and compared to the savings and resources resulting from self-monitoring activities.

The company should therefore develop and improve the accounting system, propose a resource allocation system to make monitoring investment easier, find the necessary funds within the facility and create, for example, a specific budget item for self-monitoring and other environmental investments.

Annex A

Data Collection and Processing

Annex A

DATA COLLECTION AND PROCESSING

The general objective for the self-monitoring system is to produce data that is representative, repeatable, reliable, compatible and comparable. These characteristics is dependent on the applied measures for quality control and quality assurance throughout the data production chain i.e. volume determination, sampling, sample pretreatment, treatment and analysis, data processing and reporting. Data production chain is explained in Section 3.

1- Reliability

The realism and correctness of the measurement results should be assessed against the knowledge of the processes and inputs, e.g. by using mass balance calculations.

Good knowledge of the process: This is essential for achieving reliable emission data. Process input variations can include varying properties of the raw material, chemicals or fuel used in the processes, and the size of the input. The interdependency between the inputs, processes and outputs (products and environmental load) should be known to be able to assess the correctness of the monitoring results.

Total uncertainty: The results obtained from any measurement have a specific uncertainty. It is important that the uncertainty is estimated and taken into account when the results are used in process management or for regulatory purposes. For example, the measurement result 10 g/t ± 2 g/t indicates that the uncertainty for this specific measurement is 20 % of the measured value.

Each step of the data production chain has an uncertainty and the total uncertainty of the measurement is the sum of these partial uncertainties. Uncertainty of each step of the data production chain must be known in order to be able to give the uncertainty of the final results, i.e. the uncertainty of the whole data production chain. When assessing the measurement uncertainty it is good to keep in mind that the factors causing measurement error can also affect each other.

Calibration and maintenance have to be carried out according to the relevant instructions and the management of them must be documented.

Reference measurements are carried out to certify the reliability of the measurements in practice. Results of an independent and neutral measurement laboratory are compared with the operator or consultant monitoring results. Reference measurements should be carried out regularly.

2- Comparability

Monitoring systems at the individual plants differ according to the scale, production, capacity or economic aspects of the operation. Data on necessary auxiliary measures and good documentation of the measurement procedure improves both the comparability and reliability of the results. All reference data, i.e. auxiliary measures and reference data (inputs and outputs) should be clearly defined in the monitoring program or permit according to the nationally and internationally used standards and guidelines.

3- Data Production Chain

The different parts of the monitoring system of a plant include diverse factors affecting the reliability and comparability of the emission data. These factors have to be taken into consideration in sampling, sample treatment and analysis as well as in processing and reporting of the data. Requirements for the whole data production chain should be set in the monitoring program.

Data Production Chain: The data production chain includes the following phases:

- *Determination of volume/amount*
- *Sampling*
- *Sample pretreatment*
- *Sample treatment*
- *Sample analysis*
- *Data processing*
- *Reporting*

Determination of volume/amount**:** The accuracy of determination of the volume of the release has a substantial impact on magnitude of the total emissions. Variations in the volume measurement results can be caused either by variations in the flow of the emission or in the accuracy of the measurement. Measurement of volume flow or amount of the emission can be continuous, periodic or single.

Sampling: Continuous emission analysis includes sampling, sample pretreatment, sample treatment and analysis. Variations in the process or emission treatment affect also the quantity and quality of the sample. Both sampling conditions and the sampling point must be representative. Measurement of emission concentration can be continuous, periodic or single. The sample must be representative in relation to the measurement point, emission flow/amount, sampling period and time period.

Sample pretreatment**:** Sample pretreatment includes all treatment of the sample before it is taken to the laboratory. The need for sample pretreatment is determined by the needs to protect the substance to be determined from any changes before analysis. Usually the appropriate pretreatment method is presented in the standards.

Sample treatment: Sample treatment includes operations in the laboratory before analysis, such as dilution, concentration, pH adjustment, adding of reagents. Sample treatment is usually carried out according to standards or specific method instructions. The treatment methods used should be documented.

Sample analysis: Sample analysis includes physical, chemical or biological determination of the parameter. Figures presented in emission reporting are not always comparable, without describing the analysis methods used.

Data processing: The calculation methods for the emission data are process specific and their function is to give as true load data for the specific process as possible. The correspondences of the equations to the reality must be checked from time to time and automatically in cases of any changes having an impact on them. The following general rules for emission calculation need to be determined and used nationally to harmonize the methods:

- calculation methods for the peak of an hour, calendar day, monthly/annual means
- amount of emission data needed for calculation of the annual mean of the emission
- exceeding times, i.e. percentage of time of the exceptional emissions of the total operation time
- utilization rate for the continuous measurements, i.e. percentage of time during which the measurement system has not been available of the total operation time
- calculation formulas used for data conversion into reference conditions
- conversion factors used for data conversion between different units
- calculation methods for total emissions over a certain period

Reporting: Data reporting should include sufficient data on the parameters, pollutants and other measures that are defined in the monitoring plan. The data to be reported should be presented in the form required with all the additional information and documentation.

A ***monitoring report*** is a uniform presentation of the emission data over a fixed period. Annual monitoring report-providing information of the past calendar year is always required. In case of large industrial sites, shorter period reports are demanded (a monthly report or a report over 3, 4 or 6 months). Emission data must be presented in a form easy to compare with the given emission limits. The following data is needed for reporting:

- *The emission parameters and pollutants* are reported with all the relevant the reference parameters, auxiliary measures and uncertainties expressed as required in the monitoring program in one or more of the following forms:

- Specific emissions (ton / ton of production): used for assessing performance or efficiency
- Total emissions (t/ year) : used for assessing the environmental load
- Concentration (mg / m^3, PPM, % O_2): used for e.g. operation control
- Flow rate (m/s): used for e.g. velocity/rate for flue gas/effluent
- Residence time (s): used e.g. for assessing completeness of combustion
- Temperature (^{0}C): requirements for controlling certain exhaust pollutants.
- Heat (W): thermal stress in the recipient
- The *exceptional and diffuse emissions* are included in the total emissions of the period.

- *Operation control data* should be available to the authority.
- *Utilization rate* of the measurement system is expressed e.g. as percentage of the process operation time.
- *Documentation of the reference measurements.*

4- Quality control and quality assurance

Quality control is a system of routine technical activities to measure and control the quality of monitoring data as it is being produced. QC includes e.g. checking of equipment, methods and procedures, and that the monitoring system is regularly calibrated and maintained. The relevant instruments personnel and analytical laboratories should be certified under recognized schemes.

Quality assurance includes a system of reviewing the implementation of the quality system by personnel not directly involved in the monitoring process. QA reviews verify that the quality objectives are met and ensures that the monitoring carried out represents the best available results.

Guidelines for the below listed factors help to harmonize the practical factors at site level. The monitoring plan can determine the listed factors even in details. If the plant or the laboratory uses a sub-supplier in any step of the data production chain, the competence of the sub-supplier has to be checked, too. Quality system work involves the following processes:

Data production chain
Maintenance and calibration
Certification and Accreditation

Annex B

THE ENVIRONMENTAL REGISTER

Annex B

THE ENVIRONMENTAL REGISTER

General Information:

- Name of the Facility:
- Address:
- Contact Person:
- Position:
- Time Period covered by the current data:

General Description of the facility:

- Industrial Sector:
- Actual Production:
- Production Capacity:
- Products:
- Capital Investment:
- Annual Turnover:
- Number of Employees:
- Year of Start of Operations:
- Major Renovations:

Location:

- The location of the plant shown on a map describing also neighboring areas.
- Layout describing the location of the building, unit processes, storage areas and other parts of the plants of wastewater and air emission points to be shown on the layout.
- The maps should also show types of the surrounding and sensitive areas (Hospitals, Schools, Settlements, Parks).

Raw Materials:

- Use of raw materials & auxiliary materials (ton/year)
- Opening times for processes shall be reported as follows:
    1. Annual average operating time (days/year or hour/year)
    2. Weekly operating time and operating days per week

3. Daily operating time and shifts per day
4. Possible daily or seasonal variations

- Maximum amounts of each kept in storage
- Describe storage area
- Danger substance:

List of hazardous substance used

Name of substance	Annual consumption	Environmental properties (flammability,厖)

- Describe storage areas (capacities, preventive emergency, constructions, ventilation,厖 ..).
- The method for circulation of the danger substance by (hand, windlass,厖).

Water:

- Sources of water.
- Amounts of water taken per source and year.
- Use of water:
  1.For processes
  2.For lighting
  3.For other purposes

Laws and Legislation:

- State laws & regulations pertinent to the establishment. Attach copies of possible decisions and permits:
  1. Law no. 4/94 (yes or no)
  2. Law no. 93/62 (yes or no)
  3. Law no. 48/82 (yes or no)
  4. Law no. 137/81 (yes or no)
- Attach copies of the correspondence with EEAA & other environmental authorities.

Process Description:

- Attach copies from schematic diagrams for each unit processes.
- Describe the utilities (e.g. boilers).
- Usage of raw water for each unit:

Name of Unit	Water consume

- Usage of energy & fuels for each unit:

Name of Unit	Fuels consume

Gaseous Emissions:

- Describe the gaseous emissions (for each stack).
- Name of each unit giving rise to air pollution.
- Rate of gas emission (m^3/year):

Pollutants	Concentration of Pollutants mg/m^3	Limits of Law 4/94 for Combustion of Fuels mg/m^3	Limits of Law 4/94 for Emission of production processes mg/m^3	Loads of Pollutants ton/year

- This table for each stack.
- Measure the conc. of pollutants according to Annex no. 6 in the Executive Regulations of Law 4/94 if this emission generated from unit processes but if this emission generated from combustion of fuels so the measurement of the conc. of pollutants according to Article no. 42 in the Executive Regulations of Law 4/94.
- Describe all treatment facilities for gaseous emissions (estimate, material balance, individual measurement, continuous monitoring of process parameter, and continuous monitoring of emissions).

- Treatment processes for gaseous emissions:
  1. Name of unit linked by the equipment of treatment
  2. Type of the equipment
  3. Describe the equipment
  4. Design efficiency %
  5. Actual efficiency %
- Pollution before & after treatment:

Conc. of the pollutants before treatment mg/m^3	Conc. of the pollutants after treatment mg/m^3	Loads of the pollutants before treatment ton/year	Loads of the pollutants after treatment ton/year

- Fill this table for each treatment unit.
- Describe treatment, transport, and disposal of sludge from air pollution control

Wastewater Emissions:

- Attach copy show discharge points of industrial sewerage and domestic sewerage on the maps.

Wastewater Treatment Plant:

Describe wastewater treatment facilities with layouts and drawing. The following information shall be given:

- Processes flow diagram
- Machinery
- Design parameter
- The unit linked by the equipment of treatment.
- Type of treatment (initial, secondary, advanced).
- Capacity of the plant (m^3/hour).
- Type of equipment.
- Describe the treatment of sludge.
- Describe the way used for disposal of sludge.
- Loads of pollutants:

Pollutants	Loads of pollutants for income water	Loads of pollutants for outcome water

- The design efficiency (%) & actual efficiency.
- Monitoring of efficiency

Sewage Discharge:

Fill the following table for pollutants according to discharge points and discharge points after the treatment.

Pollutants	Conc. of Pollutants (mg/l)	Limits of Law	Loads ton/year

- The concentration of pollutants measure according to the annex no. 1 of the Executive Regulations of Law 4/94 if the wastewater is discharged into the sea.
- The concentration of pollutants measure according to modify by Decree 9 for 1989 if the wastewater discharge into Municipal Sewerage.
- The concentration of pollutants measure according to the Article no. 61, 62, 66 of Law no. 48/82 if the wastewater discharge into Fresh water or Non fresh water.

Solid Waste Loads:

- Solid waste for each unit
- Name of each unit

Kind of Solid Waste	The Quantity of Solid Waste ton/year	Volume of Solid Waste m^3/year	Notes
• Paper • Plastics • Glasses • Organic Compound • Metals • Anther Materials			

- Fill this table for each unit.

- Describe the waste disposal areas (total solid waste)

Kind of Solid Waste	The Quantity of Solid Waste ton/year	Volume of Solid Waste m3/year	Notes
• Paper • Plastics • Glasses • Organic Compound • Metals • Anther Materials			

<u>Hazardous Wastes (Article no. 28 of Law no. 4/94):</u>

- Hazardous waste for each unit (Name of units):

Kind of Hazardous Waste	The Quantity of Hazardous Waste ton/year	Volume of Hazardous Waste m3/year	Notes

<u>Working Environment:</u>

- According to Annex no. 7,8,9 of Law no. 4/94
- Name of each unit

Pollutants	Conc. of Pollutants (mg/m3)	Limits of Law no. 4/94	Loads ton/year
• Temperature • Humidity • Noise • Heat • Vibrations • Bacteria & Viruses • Odors • Other Emissions			

Self Monitoring of Emissions

Article no. 17 of Law no. 4/94:

Wastewater:

- Parameters monitored (BOD, COD, TDS, TSS, Heavy metals, etc.)
- Sampling Location, Sampling Frequency and Time Table.

Sampling Location	Time between Samples

- Analytical Procedures:
- The person who responsible for monitoring and reporting

Gaseous Emission from Stacks:

- Parameters monitored (NOx, Sox, COx, CO, 厖 . Etc.)
- Sampling Location, Sampling Frequency and Time Table.

Sampling Location	Time between Samples

- Analytical Procedures
- The person who responsible for monitoring and reporting

Working Environment:

- Parameters monitored (dust emissions, odors, noise, .. etc.)
- Sampling Location, Sampling Frequency and Time Table.

Sampling Location	Time between Samples

- Analytical Procedures
- The person who responsible for monitoring and reporting

ANNEX (C)

EGYPTIAN ENVIRONMENTAL

LAWS AND REGULATIONS

ANNEX (C)
EGYPTIAN LAWS AND REGULATIONS

There are a number of laws and regulations that address the different environmental violations, summarized as follows:

4.1 Concerning Air Emissions

Article 40 of law 4/1994, article 42 of the executive regulations and annex 6 deals with gaseous emissions from combustion of fuel. Statutes relevant to the fuel combustion are:

- The use of solar oil and other heavy oil products, as well as crude oil shall be prohibited in dwelling zones.
- The sulfur percentage in fuel used in urban zones and near the dwelling zones shall not exceed 1.5%
- The design of the burner and fire-house shall allow for complete mixing of fuel with the required amount of air, and for the uniform temperature distribution that ensure complete combustion and minimize gas emissions caused by incomplete combustion
- Gases containing sulfur dioxide shall be emitted through chimneys rising sufficiently high in order that these gases become lighter before reaching the ground surface, or using fuel that contains high proportions of sulfur in power generating stations, as well as in industry and other regions lying away from inhabited urban areas, providing that atmospheric factors and adequate distances to prevent these gases from reaching the dwelling and agricultural zones and regions, as well as the water courses shall be observed.
- Chimneys from which a total emission of wastes 7000-15000 Kg/hr, shall have heights ranging between 8-36 meters
- Chimneys from which a total emission of gaseous wastes reaches more than 15000 Kg/hour, shall have heights exceeding at least two and a half times the height of surrounding buildings, including the building served by the chimney.
- The permissible limits of emissions from sources of fuel combustion are given in table (13)

Table (13) Maximum limits of emissions due to fuel combustion

Pollution	**Maximum limits mg/m^3 of exhaust**	
	Existing	**New**
Sulphur Dioxide	4000	2500
Carbon Monoxide	4000	2500
Volatized ashes in urban regions	250	250
Volatized ashes in remote regions	500	500
Smoke	250	250

The maximum limits of air pollutant emissions in the workplace relevant to the various textile processes are shown in table (14).

Table (14) Limits of Air Pollutants Relevant to the Textile Industry (law 4/1994)

Pollutant	Relevant processes	Threshold Limits			
		Mean time		Limits of exposure for a short period	
		ppm	mgm^3	ppm	mg/m^3
Cotton dust and fluff	Spinning, weaving knitting, ..etc.		0.2		0.6
Sulfuric acid	Desizing, viscose spinning, dyeing carbonizing				
Sodium hydroxide	Scouring, mercerizing wastewater treatment		2		
Chlorine	Blenching	1	3	3	9
Aniline	Dyeing	2	10	5	20
Ammonia	Dyeing	25	18	35	27
Ethylene	Dyeing		10		20
Urea	Printing				
Formaldehyde	Printing, finishing	2	3		
Acetic acid	Printing	10	25	15	37
Xylene	Printing	100	435	150	655
Acrylonitrile	Finishing	2			
Silicon	Finishing			20	
Yellow phosphorus	Finishing		0.1		0.3
Toluene	Finishing	100	375	150	560
Paraffin wax	Finishing		2		6
Manganese smokes	Workshop				
Carbon monoxide	Boilers	50	55	400	440
Carbon dioxide	Boilers				
Carbon dioxide	Boilers				
Nitrogen dioxide	Boilers, sizing	3	6	5	10
Sulphur dioxide	Boilers	2	5	5	10
Soldering smoke			5		
Ozone	Toluene solvent coating	0.1	0.2	0.3	0.6

4.2. Concerning effluents

Limits for pollutants in wastewater vary depending on the type of receiving water body. The parameters that should be monitored and / or inspected are BOD, COD, pH, temperature, residual chlorine, TSS, TDS, Oil and Grease.

Table (15) presents the permissible limits for discharges to the different recipients (sea, Nile, canals, agricultural drains, public sewer) according to the different relevant laws. Spent lube oil has a negative impact on water and soil and therefore its disposal should be monitored / inspected. A record should be kept for this purpose.

Table (15): Egyptian Environmental Legal Requirements for Industrial Wastewater

Parameter (mg/1 unless otherwise noted)	Law 4/94: Discharge Coastal Environment	Law 93/62 Discharge to Sewer System (as Decree 44/2000)	Law 48/82: Discharge into:			
			Underground Reservoir & Nile Branches/Canals	Nile (Main Stream)	Drains	
					Municipal	Industrial
BOD (5day,20 deg.)	60	<600	20	30	60	60
COD	100	<1100	30	40	80	100
PH (Grease)	6-9	6-9.5	6-9	6-9	6-9	6-9
Oil & Grease	15	<100	5	5	10	10
Temperature (deg.)	10C>avg. temp of receiving body	<43	35	35	35	35
Total Suspended Solids	60	<800	30	30	50	50
Settable Solids	—	<10	—	20	—	—
Total Dissolved Solids	2000	—	800	1200	2000	2000
Chlorine	—	<10	1	1	—	—

4.3. Concerning solid waste

A number of laws address solid waste management. The following laws apply to scrap and sludge from the WWTP:

- Law 38/1967 which addresses public cleanliness, regulates the collection and disposal of solid wastes from houses, public places, commercial and industrial establishments.
- Ministry of Housing, Utilities and Urban Communities (MHUUC) decree No. 134 of 1968, which provides guideline from domestic and industrial sources, including specifications for collection, transportation, composting, incineration and land disposal
- Law 31/1976, which amended law 38/1967
- Law 43/1979, the law of local administration, which provided that City councils are responsible for "physical / and social infrastructure", effectively delegating responsibility for infrastructure functions.
- Law 4/1994 regulates incineration of solid waste.

4.4. Concerning work environment

Violations of work environment could be encountered:

- In the boiler house: gas emissions, regulated by article 43 of law 4/1994, article 45 of the executive regulations and annex 8.
- Wherever heating is performed: temperature and humidity are regulated by article 44 of law 4/1994, article 46 of the executive regulations and annex 9
- In air conditioning systems: Freon leaks are regulated by article 43 of law 4/1994, article 45 of the executive regulations and annex 8
- Near heavy machinery: noise is regulated by article 42 of law 4/1994, article 44 of the executive regulations and table 1, annex7
- Ventilation is regulated by article 45 of law 4/1994 and article 47 of the executive regulations.
- Smoking is regulated by article 46 of law 4/1994 and article 48 of the executive regulations, and law 52/1981
- Work environment conditions are addressed in law 137/1981 for labor, Minister of Housing Decree 380/1983, Minister of Industry Decree 380/1982

4.5 Concerning hazardous material and waste

Law 4/1994 introduced the control of hazardous materials and waste. The textile industry uses a wide range of chemicals in the wet processes, many of them are hazardous. These chemicals and the fuel for the boilers, fall under the provisions of law 4/1994. Articles 29 and 33 of the law make it mandatory for those who produce or handle dangerous materials in gaseous, liquid or solid form, to take precautions to ensure that no environmental damage shall occur. Articles 25,31 and 32 of the executive regulations (decree 338 /1995) specify the necessary precautions for handling hazardous materials. Storing of fuel for the boilers is covered by the law 4 as hazardous material. There is no explicit articles in law 4/1994 or in decree 338/1995 (executive regulations), regarding holding a register for the hazardous materials; article 33 is concerned with hazardous wastes, such as sludge resulting from wastewater treatment of the textile wet processes effluents. However, keeping the register for the hazardous materials is implicit in article 25 of the executive regulations regarding the application for a license.

4.6. Concerning the Environmental Register.

Article 22 of law 4/1994 states that the owner of the establishment shall keep a register showing the impact of the establishment activity on the environment. Article 17 and Annex 3 of the executive regulations specify the type of data recorded in the register.

The emergency response plan and the hazardous materials register will also be part of the environmental register.

Annex (D)

REFERENCES

Annex (D)

REFERENCES

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