

United Nations Environment Programme Regional Activity Centre for Cleaner Production Mediterranean Action Plan

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MINIMISATION-ORIENTED ENVIRONMENTAL DIAGNOSIS

(MOED)



Autonomous Government of Catalonia
Ministry of the Environment
Centre for Cleaner Production Initiatives



UNEP



Ministry of the Environment
Spain

**MINIMISATION-ORIENTED
ENVIRONMENTAL DIAGNOSIS
(MOED)**

**Centre for Cleaner
Production Initiatives**

1. Introduction

One of the underpinnings of environmental prevention and waste and emission minimisation is the **knowledge of waste flows** generated in industrial processes and activities and of the minimisation alternatives which exist for each of these flows.

Lack of knowledge is often the main obstacle which impedes companies to adopt suitable measures in the field of pollution prevention.

On the other hand, having information on hand regarding waste flows, the causes of their generation, their characteristics and the cost of treatment and management, gives a company the motivation and tools required to undertake minimisation measures and go down the path towards pollution prevention.

Therefore, the **Centre for Cleaner Production Initiatives provides support for companies** wishing to diagnose their environmental positions by means of what is known as a **Minimisation-Oriented Environmental Diagnosis (MOED)**.

2. What is a MOED? What isn't?

WHAT IS A MOED?

- A MOED is **the assessment of an industrial activity** to determine the possible **opportunities to prevent pollution at the source (reduction and recycling at the source)** and the measures to be adopted in order to direct corporate policy towards practices and technologies which make them feasible.
- A MOED can diagnose **an entire industrial facility** or **only a part** of one (a specific plant bay, process line, etc.).
- A MOED is an assessment performed by an **expert who is well-versed in each particular industrial activity**.
- A MOED is an assessment which, **performed in a relatively brief period of time**, provides a company with **sufficient technical and economic information** regarding existing options so that it may assess the convenience of undertaking minimisation measures.

WHAT ISN'T?

- A MOED **is not an environmental audit**, although it may be a useful element in any certification process.
- A MOED **is not a generalised assessment**; on the contrary, it is specifically focused on assessing existing **specific minimisation options**.

3. What are the basic elements of a MOED?

So that the reports drafted as a result of a MOED have a similar structure, the proposed index should be based on or be similar to the one specified below:

- 1) Introduction or background.
- 2) General description of the company.
- 3) Description of the industrial facility and manufacturing processes, activities or areas that are diagnosed.
- 4) Enumeration and description of waste flows generated. Causes of such generation. Current means of waste management.
- 5) Description, wherever possible, of recommended alternatives and reasons for recommending them (technical and economic feasibility).
- 6) Summarised chart including minimisation alternatives and economic assessment, including estimated investment payback times for the different options analysed. Appendix A presents a model of the summarised chart.
- 7) APPENDICES: Process charts, protocols used, worksheets, etc.

4. How should a MOED be conducted?

In order to prepare the MOED as described, the expert or consultant should prepare an ad hoc questionnaire or **data protocol** enabling him or her to systematically monitor the industrial activity to be diagnosed.

One of the objectives of a MOED is to present feasible technical and economic alternatives whenever possible of the opportunities for pollution prevention that have been detected. That is, it is convenient to have enough data on hand to be able to compare the company's current costs with what it would cost to adopt each of the proposed alternatives. In order to make this comparison, it would be necessary to know data concerning the proposed alternatives (investment in equipment, operating costs of different facilities, purchase price of alternative products, etc.) and also data relative to the diagnosed company's current cost setup. Only if these data are available it is possible, in some cases, to estimate the savings which can be achieved by implementing the proposed improvements, as well as the payback of required investments. It is for this reason that the data collection protocol includes questions regarding the purchase and sale price of products, plant operating costs, environmental management expenses, etc. If these data are not available, the MOED report can only suggest technically feasible alternatives to the prevention opportunities detected.

The protocol must contemplate, at the very least, the following items:

- General information regarding the company, such as name, address, activity, number of employees, contact person, etc.
- Data regarding the industrial facility (or processes if it is a partial MOED) that are the object of the diagnosis, with a brief description of the different areas and manufacturing processes.
- Data concerning raw materials (including water) and auxiliary materials (especially consumption, technical specifications, storage form and time, and purchase prices).
- Data concerning the end-product(s), including production volume, features, storage form and time, and sale prices.
- Manufacturing process schemes. Technologies used. Description of equipment. Energy consumption and cost.

- Forms of work, organisation, existence of written procedures, training, information, etc.
- Data regarding generated waste flows (waste, wastewater, atmospheric emissions) including amount, origin or cause of generation, characteristics and cost of treatment and/or management.

Appendix B presents a proposed standard **checklist** for obtaining information from the company. This checklist can be modified according to the type of company to be diagnosed, the scope of the MOED, etc. Under no circumstances does this replace the data collection protocol; it is simply a reminder of general issues.

In order to systematically collect and summarize the information provided by the company and that collected by the expert, the latter shall prepare **worksheets** similar to those attached as Appendix C. As indicated in point no. 3, the MOED report will include in its appendices, among other documents, the data collection protocol and summary worksheets.

Although in practice the MOED can be performed according to the expert's or consultant's specific knowledge and experience and the characteristics of the plant or activity that is to be diagnosed, in order to standardize as much as possible both the methods and the form in which the results are expressed, it is considered convenient to complete the following tasks as part of the required work:

- Prepare a list of processes and activities which are carried out in the diagnosed facility/activity.
- When it is deemed necessary due to the complexity of the process, subdivide the processes into subprocesses with a certain common identity in order to analyse them separately.
- Identify especially those processes and activities which use materials with characteristics that are potentially harmful to the environment.
- Carry out an inventory of the raw materials, ancillary materials and additives that are involved in the subprocesses, as well as the resulting materials.

- Carry out an inventory of the waste and emissions, whether inert, special or non-special, in every subprocess.
- Process information on the costs of materials used in the different processes, of water, energy, wastewater treatment, waste management, etc. in order to evaluate subsequent savings achieved using proposed minimisation options. In the specific case of wastewater, atmospheric emission and waste treatment and management, consider both those that the facility is already handling and those that it would handle if correct management were implemented.
- Identify the most significant losses in terms of processes and activities, by analysing balances of required materials, including water, and comparing them to generated atmospheric emissions, wastewater and waste.
- Identify and analyse the processes which, bearing production capacity in mind, generate the most waste, wastewater and atmospheric emissions and/or which are the most polluting processes.
- Identify potential minimisation opportunities and propose, whenever possible, technically feasible alternatives, distinguishing between reduction at the source and recycling at the source.
- Estimate and justify quantitative reductions which could be achieved by applying each and every one of the proposed alternatives.
- Evaluate, whenever possible, the cost of each proposed alternative and determine the approximate payback period.
- Establish an approximate timetable for the execution of necessary projects that are required to implement the alternatives that are identified as technically and economically feasible.

The MOED report prepared should include information about the tasks mentioned above following the index proposed in point no. 3.

APPENDIX A: SUMMARY MINIMISATION ALTERNATIVES CHART MODEL

MINIMISATION OPPORTUNITY DETECTED	PROPOSED ALTERNATIVE	APPROXIMATE COST	ESTIMATED PAYBACK
Opportunity 1	Alternative 1	PTA	years
	Alternative 2	PTA	years
Opportunity 2	Alternative 1	PTA	years
	Alternative 2	PTA	years
	Alternative 3	PTA	years
etc.	etc.	etc.	etc.
TOTAL		Σ Cost of proposed alternatives	Estimated payback (years)

APPENDIX B: PROPOSED MOED CHECKLIST

A-1. General Company Information

- Size of company, industrial sector.
- Total number of employees. Number of employees per product line or department.
- General organisation structure.
- Products manufactured and amounts. Very general descriptions of processes.
- Manufacturing hours, shifts.
- Annual turnover.*

- Electric energy consumption and cost.
- Fuel consumption (gas, fuel, etc.) and cost.
- Steam generation. Cogeneration? Cost of steam consumption.
- Raw materials consumption (source, costs).
- Water consumption (source, costs).

- Wastewater: characterisation, place of disposal, installed treatment and purification systems.
- Total waste (special, non-special, inert). Source. Type of management.
- Atmospheric emissions. Focus. Treatment systems, filters, etc. installed. Fugitive emissions?
- Cost of waste management (transport, rubbish dump, treatment, etc.).
- Cost of wastewater treatment, sewage royalties.
- Cost of emission treatment.

- General description of service units: energy, water (treatment of incoming water), wastewater, materials storage (raw materials, ancillary materials, end-products) etc.
- Does the company have an engineering department?
- Does the company have a maintenance department?

- Are there training programmes in general and environmental programmes in particular for company personnel?
- Environmental documentation (statement of disposed pollutant charge, waste statement, emission register, -CAPCA-).

A-2. Information relative to different manufacturing processes

- Product, features, and quantity manufactured yearly.
- Percentage of virgin (raw) and recycled materials in each product (Where does recycled material come from? How is it recycled?).
- Process: continuous, discontinuous, semi-continuous...
- Detailed description of manufacturing process (description of each subprocess).
- Inputs and outputs of each process:
 - ↳ Inputs: raw materials, ancillary materials, additives, etc.
energy, water
incoming product from previous subprocess
 - ⇒ outputs: atmospheric emissions
waste
liquid effluents
energy, water
(noise and smells)
product for next subprocess
- Description of cleaning processes of tanks and facilities (materials, substances, equipment, etc. used, frequency, scheduling, etc.) for each subprocess.
- Description of maintenance of equipment and facilities used in each subprocess (scheduling, frequency, etc.).
- Description of other discontinuous non-manufacturing operations for each subprocess (e.g. transfers or handling).
- Form of reception, loading and unloading of raw materials and products, types of packaging and equipment used (tanks, containers, drums, bags, manual conveyance, automatic conveyance, etc.).
- Specifications of raw materials, ancillary materials, chemicals, etc. (toxicity, other special features, etc.).
- Storage of raw materials (silos, tanks, warehouse organisation, inventories, etc.).
- Storage of finished products. Product packaging (how packaged, weight, product weight/package weight ratio, etc.).
- Management of customer-returned orders. Possibility of re-processing.
- Costs associated with manufacturing process for each product (raw materials, energy, water, labour, lost materials cost...).

APPENDIX C: PROPOSED MOED WORKSHEETS

Company: _____ Facility: _____ Date: _____	<u>MOED</u> -Worksheets-	Worksheet no. Page ____ of
General Description of Company		
<p>Company:</p> <p>Headquarters:</p> <p>Telephone: _____ Fax: _____</p> <p>Products manufactured:</p> <p>Raw materials and other significant materials:</p> <p>Primary activity:</p> <p>Sector: _____ CNAE: _____</p> <p>Total number of workers:</p> <p>Type of company:</p> <p>Annual turnover: _____ Small/medium size co.: Yes/No</p> <p>Corporate environmental policy, programmes, resources:</p>		

Company _____	MOED -Worksheets-	Department _____
Facility _____		Process _____
Date _____		Subprocess _____
		Worksheet no. _____
		Page _____

Description of Facility

Address of facility:

Telephone:

Fax:

Total number of workers:

Products manufactured and quantities:

Description of manufacturing processes:

(Brief) description of other areas of interest (storage, services, etc.):

Major raw materials and quantities consumed:

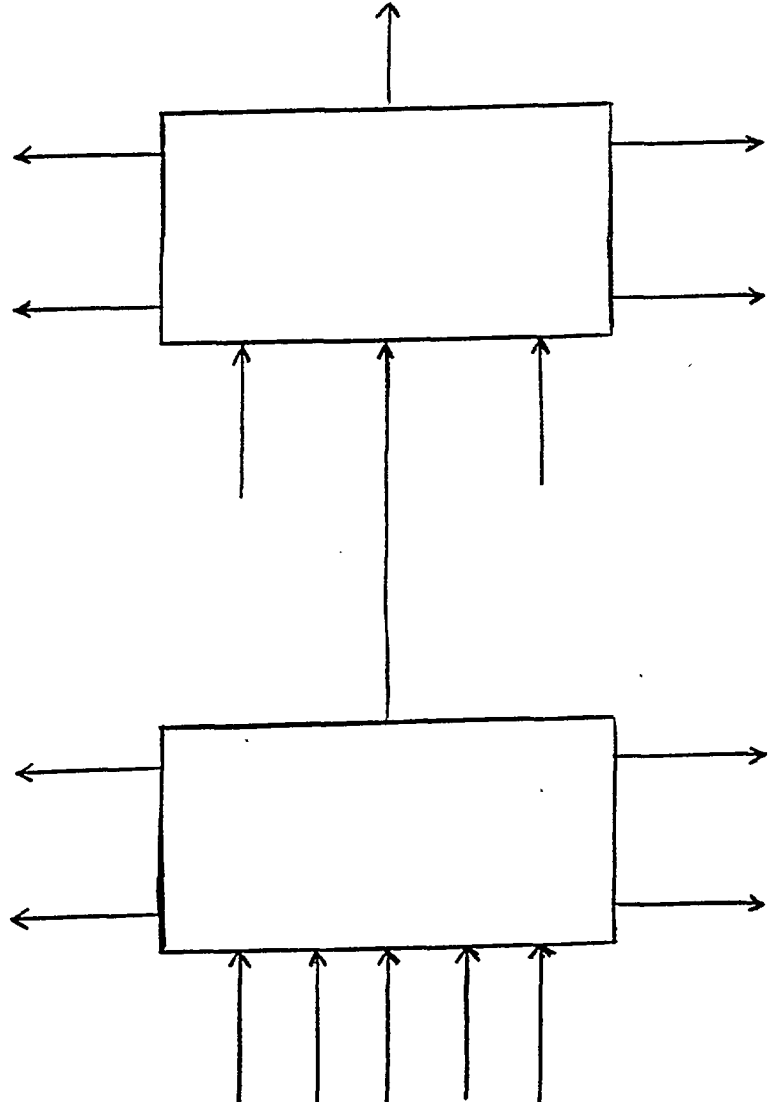
Company _____ Facility _____ Date _____	MOED -Worksheets-	Department _____ Process _____ Subprocess _____ Worksheet no. _____ Page ___ of ___	
	Process Information		
	Raw materials and auxiliaries		
Kind of manufacturing process: <input type="checkbox"/> Continuous <input type="checkbox"/> Semicontinuous <input type="checkbox"/> Discontinuous <input type="checkbox"/> Others (_____)			
Product manufactured/Production (annual, monthly, batch...):			
	R.M O	R.M O	R.M O
Raw material/auxiliary name			
Origin / Supplier			
Annual amount consumed (---/y)			
Consumption per unit produced (--/--)			
Purchase price (PTA/---)			
Annual total cost (PTA/year)			
Environment-significant components or properties ⁽¹⁾			
Form of supply ⁽²⁾			
Form of storage ⁽³⁾			
Form of transfer ⁽⁴⁾			
Has sell-by date?			
Are there possible alternatives for the raw/ancillary material?			
Supplier return possibility			
... of empty packages/containers?			
...of expired materials?			

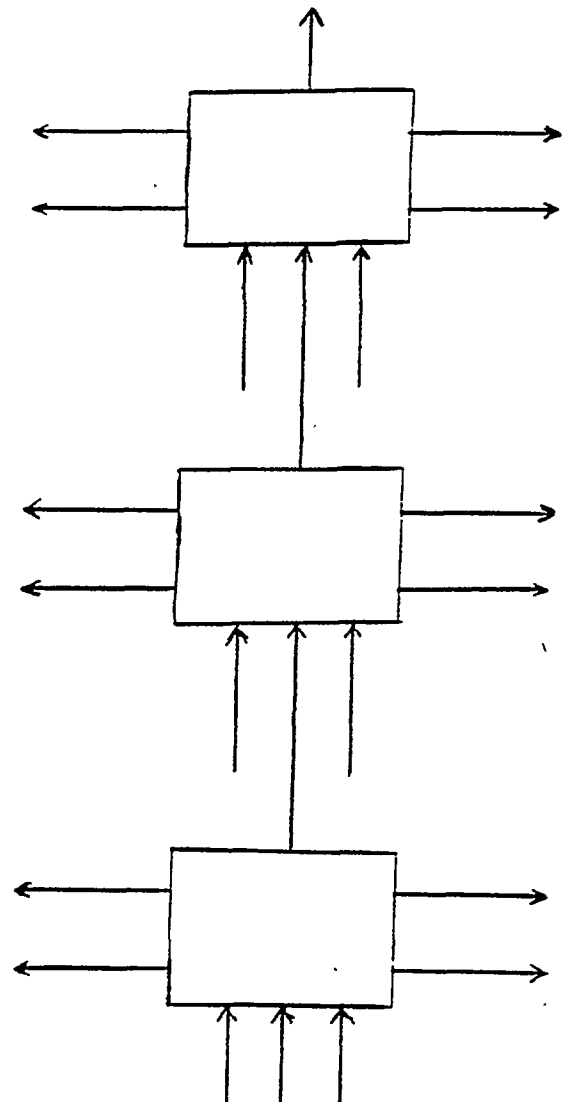
- Notes:**
- (1) heavy metals, solvents, toxicity, volatility, special waste, etc.
 - (2) hose, tanker truck, bags, drums, etc.
 - (3) containers, pallets, outdoor tanks, underground tanks, silos, etc.
 - (4) pump, gravity, pneumatic conveyance, conveyer belt, etc.

Company _____ Facility _____ Date _____	MOED -Worksheets-	Department _____ Process _____ Subprocess _____ Worksheet no. _____ Page ____ of ____
	Process Information	
	End-Products	
Product manufactured:		
Typology or product family:		
Annual production (---/y):		
Sale price (PTA/---):		
Annual turnover for this product (PTA/y):		
Environment-significant components or products:		
Form of storage:		
Form of packaging for distribution:		
Form of distribution:		
% product out of specs:		
% product out of specs that is re-processed:		
% product returned by customer:		
Post-consumption product recycling possibilities:		
Is return of packaging/containers by customer accepted?		
Other comments:		

Company _____ Facility _____ Date _____	MOED -Worksheets-	Department _____ Process _____ Subprocess _____ Worksheet no. _____ Page ___ of ___	
	Process Information		
	Waste Flows		
	Flow ○	Flow ○	Flow ○
Identification of flow (name)			
Origin / Cause of flow			
Annual amount generated (---/y)			
Environmentally significant components or properties (and %) ⁽¹⁾			
Have attempts been made to reduce currently generated amounts at the source?			
Is the waste flow recycled at the source?			
Type of management or treatment?			
Cost of in-house treatment (PTA/y)			
Cost of outsourcing management (PTA/y) ⁽²⁾			
Is minimisation feasible?			
Is valuation feasible?			
Possible reduction opportunities at the source			
Possible recycling opportunities at the source			
Possible valuation opportunities			

Notes: (1) heavy metals, solvents, toxicity, volatility, special waste, etc.
(2) transport, rubbish dump, management, etc.

<p>Company: _____ Facility: _____ Date: _____</p>	<p><u>MOED</u> -Worksheets-</p>	<p>Department: _____ Process: _____ Subprocess: _____ Worksheet no. _____ Page ___ of ___</p>
<p><u>Notes:</u></p>  <pre>graph TD; L[] --> R[]; L --> L1[]; L --> L2[]; R --> R1[]; R --> R2[]; L --> L3[]; L --> L4[]; L --> L5[]; R --> R3[]; R --> R4[]; R --> R5[]; R --> R6[]; R --> R7[];</pre>		

<p>Company: _____ Facility: _____ Date: _____</p>	<p><u>MOED</u> -Worksheets-</p>	<p>Department: _____ Process: _____ Subprocess: _____ Worksheet no. _____ Page ____ of ____</p>
<p><u>Notes:</u></p>  <pre>graph TD; B1[] --> B2[]; B2 --> B3[]; B1 --> O1[]; B1 --> O2[]; B1 --> O3[]; B2 --> O4[]; B2 --> O5[]; B2 --> O6[]; B3 --> O7[]; B3 --> O8[]; B3 --> O9[]</pre>		

Company: _____ Facility: _____ Date: _____	<u>MOED</u> -Worksheets-	Department: _____ Process: _____ Subprocess: _____ Worksheet no. _____ Page _____ of _____
		<u>Notes:</u>

