# VOLUNTARY ENVIRONMENTAL INITIATIVES FOR SUSTAINABLE INDUSTRIAL DEVELOPMENT

# CONCEPTS AND APPLICATIONS

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# EXECUTIVE SUMMARY

In the 21st century, no business can successfully operate in an economic and social vacuum, but must look towards meeting the needs and the expectations of all key constituents: customers, investors, employees and the greater society. In terms of industry's responsibilities to the environment, environmental regulation has developed over time, setting limits and standards for discharges and emissions. Historically, command and control techniques were developed, often resulting in a reactive approach to environmental management. Environmental considerations were often ignored in the design, manufacturing, use and disposal of products and processes. Hazardous and toxic wastes used to be handled in the most convenient means possible, overlooking immediate and/or future health and environmental implications. Inefficient energy consumption resulted in high operating costs and ever-increasing emissions. Unfortunately, due to different and pressing priorities, these legacies are still the environmental reality in few developing countries around the world.

Over the past decades, industrial leaders have recognised the importance of the environment in which they operate, and many have pursued a path of implementing voluntary initiatives to reduce the burden on the environment, taking a more proactive approach, addressing pollution prevention to stay ahead of legislation. This represents not just good environmental sense, but also good business strategy, preparing industry to respond to changes in terms of regulation and scientific breakthrough, while satisfying the needs of the various stakeholders. There are a number of voluntary initiatives being pursued by industry, and supported by UNEP, which forms the focus of this publication.

Much of the current thinking on environmental protection focuses on what to do with wastes and emissions after they have been created (i.e. control measures), or 'end-of-pipe' treatment. What is currently being promoted is a move from this to the preventive approach embraced by Cleaner Production. Cleaner Production can be the most efficient way to operate processes, produce products and to provide services for the following reasons:

- Production processes: conserving raw materials and energy, eliminating toxic raw materials, and reducing the quantity and toxicity of all emissions and wastes.
- Products: reducing negative impacts along the life cycle of a product, from raw materials extraction to its ultimate disposal.
- Services: incorporating environmental concerns into designing and delivering services.

The cost of wastes, emissions and environmental and health impacts can be reduced and benefits from these reductions and new markets can be realised. Developing and marketing Cleaner Production is a concrete step towards sensible resource use and environmental protection and towards sustainable economic development. It promises greater profits to industries by reducing costs (reduced material requirements, reduced disposal fees, and reduced environmental liabilities and cleanup costs), and raising revenues through greater sales and exports.

Cleaner Production is a proactive environmental strategy dealing with the source of the problem (i.e., pollution prevention), as opposed to the effects and consequences (i.e., end-of-pipe treatment and/or corrective remediation). It is also a practical approach of moving towards Sustainable Development (meeting the needs of today's generation without compromising those of future generations) by allowing industries and service providers to produce more with less (e.g. factor 4) : fewer raw materials, less energy, less waste and emissions, and normally, less environmental impact and greater sustainability, making sense both environmentally and

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economically. The implementation of Cleaner Production involves specific methodologies for integrating environmental issues and sustainable development within an industrial process challenging the traditional procedures for design, manufacturing applications and services.

Cleaner Production approaches include techniques such as Pollution Prevention, Waste Minimisation, at Source Reduction, Design for the Environment, Eco-Efficiency, Green Chemistry, Sustainable Consumption, with a number of key methodologies and tools used in its implementation.

Mass Balance Analysis involves the tracking of materials, including energy, emissions and wastes, in and out of an analysis area with specific boundaries, such as a manufacturing station, a treatment plant or a watershed. Ideally mass balances are based on measurements of inflows, accumulation/decay/storage and outflows (including by-products and daughter products) over time.

Risk Analysis is a probabilistic assessment of dose-response relationship, taking into consideration the fate and transport of constituents, routes of transfer, pathways of exposure, as well as the potential recipient population(s). The assessment of risk can be outlined in five major steps: hazard identification, dose-response assessment, exposure assessment, risk characterisation and risk management (i.e. what level of risk is acceptable?).

Engineering Design, or Design for the Environment, is a complex process due to numerous competing requirements and constraints in terms of product performance and quality versus environmental impacts. Designing Cleaner Production processes and manufacturing environmentally friendly products require appropriate knowledge, tools, production methods, incentives and commitment. Designers and engineers should be trained (and indeed re-trained) to integrate environmental perspectives into their tasks.

Life Cycle Assessment is a technique for tracking all the environmental effects and resource needs of a new product or process through the material supply, manufacturing, transport, storage, use and final disposal (and even beyond, i.e. fate and transport). It is intended to provide a comprehensive assessment of environmental effects to ensure that potential risks to health and environment at the various stages of life cycle are taken into account, and that appropriate measures are put in place to manage or reduce those risks.

Full Cost Accounting Methodologies involve the incorporation of environmental considerations into the process of determining actual costs. Many industries, governments and consumers want to support Cleaner Production and green products, but are afraid of the potential high costs incurred. Full Cost Accounting seeks to account for the “hidden” costs related to social and environmental implications (e.g. resource depletion and deterioration, liability, environmental clean-up etc.).

Material selection is also important in terms of Cleaner Production, with several materials or components possibly producing a similar quality product or process. Selection guidelines can be established to direct the Cleaner Production designer/developer towards an environmentally preferred material, using some basic prerequisites, e.g. choose abundant, non-toxic materials wherever possible, employ recycled/recyclable materials and select natural materials.

There are numerous examples of applying Cleaner Production in various industries, manufacturing processes, waste management, and services, for example, solvent substitution, where with due consideration to the technological characteristics and specifications merits, the use of often toxic solvents (e.g., Cl-based solvents) are replaced by more benign alternatives

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(e.g., water-based solvents), including (but not limited to) biodegradable, non-toxic/less-toxic, water-based versus organic based synthetic solvents.

Green Chemistry, a notion conceived from the larger concept of Cleaner Production (CP). It denotes the use of chemistry for pollution prevention. The mission is to promote innovative chemical technologies that reduce or eliminate the use or generation of hazardous substances in the design, manufacture, use, and/or ultimate disposal of chemical products.

Environmental Management Systems represent a voluntary initiative addressing the systems and procedures of production in order to try and minimise environmental impacts. It is an approach used by a large number of companies, both multi-national corporations and small and medium sized enterprises, with external certification to an International Standards Organisation standard available. The Environmental Management System (EMS) addresses all aspects of an organisation's activities, including raw materials consumption, energy, process control, waste and emissions. It is a comprehensive approach to the environment that encourages and sustains an organisational structure and procedure for developing, implementing, achieving, reviewing and maintaining an effective environmental policy. An EMS operates in a similar manner to other management systems implemented by an organisation (financial, health and safety, quality), following the Deeming Cycle of Plan-Do-Check-Act for continuous improvement.

In its planning stage the system requires a complete review of activities within the organisation in order to identify the main activities that have an impact on the environment (environmental aspects) and to identify the regulations by which the organisation is bound to manage those aspects. Having assessed the environmental aspects of operation and identified the most significant of them, a series of objectives and targets are developed for improvement, broadly spelled out in the Environmental Policy. An Environmental Action Plan is then developed to achieve these objectives and targets.

To implement the system effectively, responsibilities within the organisation need to be identified as well as procedures developed to manage the environmental impacts. Top management commitment to the system must be absolute. Where necessary training should be provided to ensure that all employees have the capacity to deliver what is asked of them. Emergency response plans must also be developed to first of all identify and minimise the risk of accident, but if an accident, such as a fire or spill does occur, to minimise the impacts of the incident.

The system should be regularly audited to identify any shortfalls in the system and should also be reviewed by management to identify areas for improvement and set revised targets for continual improvement.

The implementation of an Environmental Management System as a tool of Cleaner Production can bring about improvements in process performance and significantly improve a facility's bottom line through process optimisation. There are a wide range of potential benefits of implementation, including identification of environmental priorities and compliance issues, avoidance of penalties and fines, minimisation of clean-up costs and potential civil liabilities, potential identification of cost-saving opportunities, enhanced image and enhanced attractiveness as an employer and a supplier. From an environmental perspective, there are also a number of gains, including reduction in consumption of natural resources and raw materials, reduction in emissions, reduction in waste sent for disposal and decreased risk of accidents, and if accidents do occur, appropriate response to minimise environmental impacts. As is the case for CP, an EMS is a dynamic "evergreen" target, rather than a static one.

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Despite increased interest in cleaner technology, West Asian countries have yet to benefit significantly from the experience of the industrialised nations. This is mainly because of a lack of information on waste minimisation technologies, management resistance to employing what they view as disruptive changes, and lack of policy measures conducive to investment in such technologies. There is a need to influence environmental actions for new industrial activities in the region and identify likely problems and proper mitigation measures for pollution control within these industries.

Small and medium sized industries have a particularly difficult choice making CP investments for reasons that range from the cost of capital to the absence of appropriate funding mechanisms. Furthermore, CP options are likely to be economically less attractive in countries with few and/or un-enforced environmental regulations, under-priced , free and/or subsidised natural or labour resources, and little consumer interest in products that are produced and consumed in a more environmentally responsible manner. Although the pressure of consumer movements in developing countries has so far had limited influence on decisions related to the choice of production technology, such pressure is likely to increase considerably in the upcoming years.

"Greenifying" of the production process is already taking place with some multinational companies who extend such requirements to their supply chains in developing countries. With globalisation and the information revolution consumer demand for competitive products that are environmentally sound is also increasing rapidly. Cleaner production is after all a means to increase competitiveness, especially in the global market, improve and manage industries image and reputation, promote efficiency and make the capital stock less environmentally damaging. Financial institutions have an interest in guiding their customers to positions that consider supply-side pressures, anticipated legislation, licenses and permits, and market trends.

Considering the rising costs of natural resources, the promulgation of environmental enforcement, and increasingly competitive trading, it is indisputable that the applications of voluntary initiatives in the industry is a "win-win" situation, where production costs are reduced, energy is conserved, waste and emissions are reduced and relationships with stakeholders strengthened through increased transparency.

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# INTRODUCTION

In the 21st century, no business can successfully operate in an economic and social vacuum, but rather enterprises can achieve the enduring success only by meeting the needs and the expectations of all their key constituents: customers, investors, employees and the greater society. Sustainable Development (SD)[1] demands attaining the three-dimensional balance between economic growth and social and environmental responsibility; therefore, sustainability entails the continuous fulfilment of the varying needs and sometimes-conflicting objectives of the multiple stakeholders.

In terms of industry's responsibilities to the environment, environmental regulation has developed over time, setting limits and standards for discharges and emissions. Historically, command and control techniques were developed, often resulting in a reactive approach to environmental management. Over the past decades, industrial leaders have recognised the importance of the environment in which they operate, and many have pursued a path of implementing voluntary initiatives to reduce the burden on the environment, taking a more proactive approach, addressing pollution prevention to stay ahead of legislation. This represented not just good environmental sense, but also good business strategy, preparing industry to respond to changes in terms of regulation and scientific breakthrough, while satisfying the needs of the various stakeholders.

The following document provides an introduction to a number of voluntary initiatives being promoted by UNEP's Regional Office for West Asia's Regional Industry Programme. These include:

- Cleaner Production techniques
- Environmental Management Systems
- Awareness and Preparedness for Emergencies at the Local Level
- Global Reporting Initiative
- Global Compact

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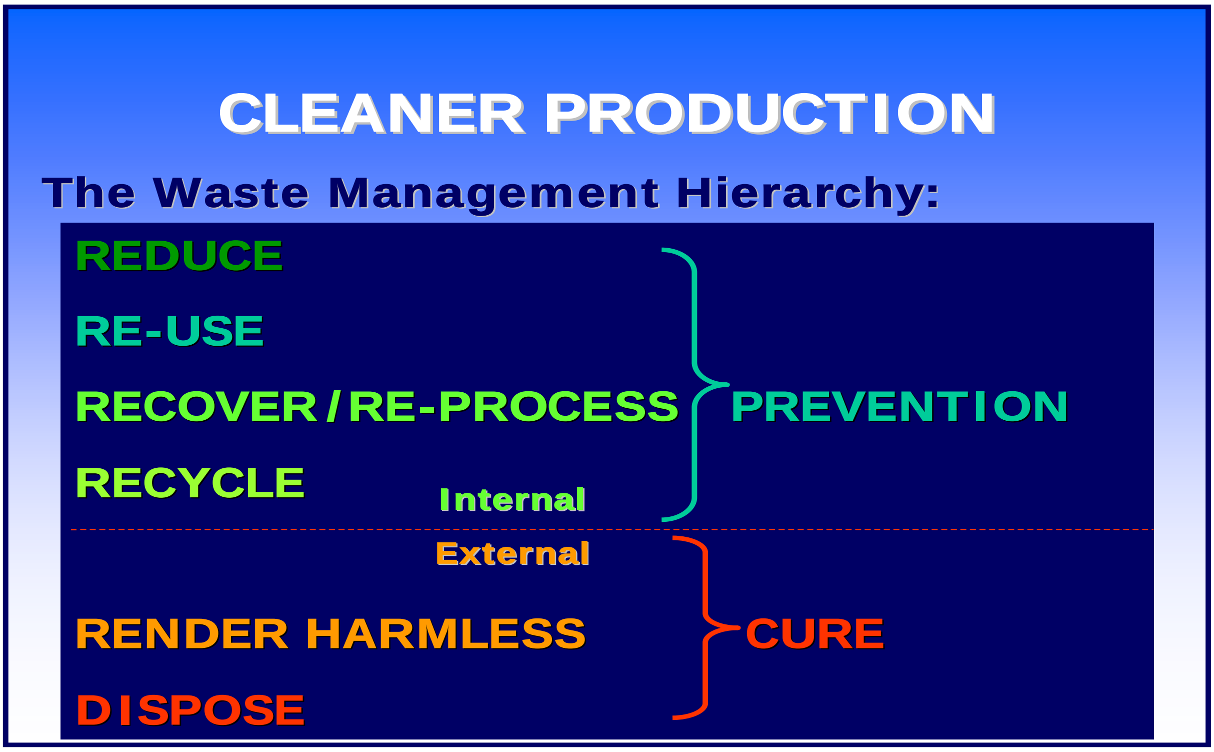
## CLEANER PRODUCTION

Cleaner Production (CP) is a proactive environmental strategy, a step beyond waste handling or management (based on "cradle-to-cradle" approach). It deals with the source of the problem (i.e., pollution prevention, $P^2$), rather than the effects and consequences (i.e., end-of-pipe treatment and/or corrective remediation). CP is also a practical approach of moving towards SD by allowing industries and service providers to produce more with less: fewer raw materials, less energy, less waste and emissions, and normally, less environmental impact and greater sustainability. CP, by definition, promises greater profits to industries by reducing costs (i.e., reduced material requirements, reduced disposal fees, and reduced environmental liabilities and cleanup costs), and by raising revenues through perhaps greater sales, exports and better Public Relations (PR).

CP has been applied to develop more environmentally benign (or even friendly) processes, products, services and impacts. The implementation of CP involves specific methodologies for integrating environmental issues and sustainable development in a particular industry, employs applications of relevant analyses and syntheses, and above all challenges the traditional procedures for design, manufacturing applications and services.

This following section provides an overall view of CP as a concept, its principles, methods and tools, its wide applications and indeed its impediments. Several industrial examples of CP applications for conserving resources, minimising wastes and emissions, reducing risks, and curtailing costs and generating profits are presented. Case studies from Chemical, Textile and Cement manufacturing industries are illustrated. Through these examples it can be demonstrated that industry and the environment are not mutually exclusive but rather

In the past, environmental considerations were often ignored in the industrial design,




manufacturing use and disposal of new products and processes. Hazardous and toxic wastes

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used to be handled in the most convenient means possible, overlooking immediate and/or future health and environmental implications. Inefficient energy consumption resulted in high operating costs and ever-increasing emissions. Adverse environmental impacts were integral parts of the life cycle, including material production, manufacturing, distribution, usage, disposal and beyond. Unfortunately, due to different and pressing priorities, these legacies are still the environmental reality in few developing countries around the world. This dilemma has become intransigent by the myth that responsible environmental practices impede development and economic prosperity and put countries at disadvantage to solve their social problems and to compete globally.

Historically, the recognition of these problems and their consequences in the developed world has necessitated the establishment of environmental regulations and legal frameworks, the clean up of past pollution problems (environmental remediation), and the commencement of complex management systems to tackle the present incessant waste streams (both hazardous or non-hazardous). Enforcement of the environmental laws and standards created reactive systems of “end-of-pipe” treatment and management however smoothed the way to innovation and development in environmental technologies and practices. In spite of the progress achieved in numerous places of the world, many environmental damages have been irreversible and many ecological consequences were ever lasting. Most developing countries are still guided by the reactive approach of environmental management at best.

Moving away from the reactive into a more proactive mode has been conceived in the last two decades of the last century, embarking on a new philosophy of environmental management: the pollution prevention approach. Many terms and jargons are currently used to describe measures that prevent environmental nuisance and harms from happening in the first place; these are Pollution Prevention, Waste Minimisation[(2)], at Source Reduction, Cleaner Production, Eco-Efficiency, Green Chemistry[(3)], Sustainable Consumption...etc. Within this proactive spirit the term Sustainable Development was borne to mean in essence “meeting the needs of today’s generation without compromising those of future generations”.

Adopting CP concept in industries offers much to the current generation and provides future generations with a planet that will enable them to survive and prosper, because the CP strategy has not one but multiple and integral goals as well as multidimensional aspects. With variable domains, CP can be pursued for example to reduce costs, to minimise wastes, to induce recycling and save raw materials, to tackle global warming, and/or to solve a particular environmental challenge (e.g., air pollution, biodiversity...etc.). Any issue of these is not a “stand-alone” but indeed an integral part of synergistic or antagonistic implications of the “Big Picture”. For instance, some pollution prevention may be socially desirable but might not be economically feasible; some recycling may have environmental burdens larger than the savings (e.g., where long distance hauling is involved, depressed market...etc.). Focusing on a single issue, such as air pollution, may result in the undesirable transfer of contamination from one medium to another (e.g., water). Accordingly, a comprehensive approach with a holistic vision is of profound significance to address SD in industry; this has been warranted in the development of CP.

The social goals for CP relate to ensuring a sustainable future for our environment and human society in terms of both resources and ecological health. One point of view claims that a sustainable future would directly result from the progressive advances in technology and knowledge, such that future generations should be well equipped to overcome any (or most) environmental problems caused now. However, there is a legitimate doubt that the requisite

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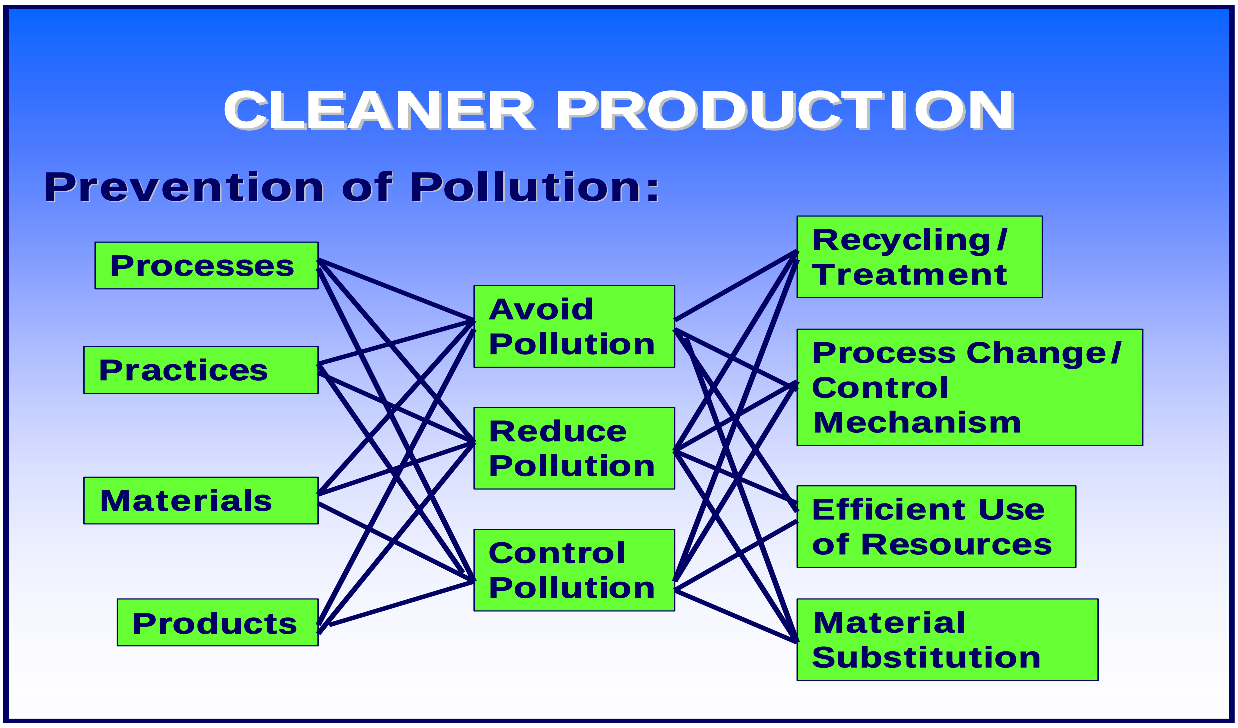
technology and/or knowledge will not be developed adequately to solve environmental problems, particularly those involving non-renewable resources for instance. In that sense sustainable development and environmental protection must walk hand-in-hand in the new era of globalisation. Four general goals, nonetheless, can be drawn from the CP concept in pursuit of a sustainable future:

1. Minimise the use of non-renewable resources
2. Manage renewable resources to ensure sustainability; and
3. Reduce, with the ultimate goal of eliminating, hazardous/toxic and otherwise harmful emissions/wastes into the environment (preferably at the source).
4. Achieve these goals in the most cost-effective manner, emphasising sustainable development.

With these overarching goals in minds, specific objectives can be implemented on a case-by-case basis in a balanced fashion considering local factors and conditions. For example, more energy-efficient automobiles can reduce the use of non-renewable fossil fuel and perhaps harmful emissions, as long as the new technology does not entail excessive environmental burdens (the car is too small for a "typical" family and therefore more cars or more trips are needed to reach the same destination). The CP process, in this sense, is not absolute, but is flexible and subject to comparison with other alternatives. In all cases the technological changes introduced by CP should essentially be more effective at reducing the overall environmental burdens and more proficient at reducing costs than traditional "end-of-pipe" clean up strategies.




**METHODOLOGIES AND TOOLS**

The key principle of the CP is to have an overall favourable impact (or at least less adverse) on current and future settings and conditions concerning human and the environment welfares. In

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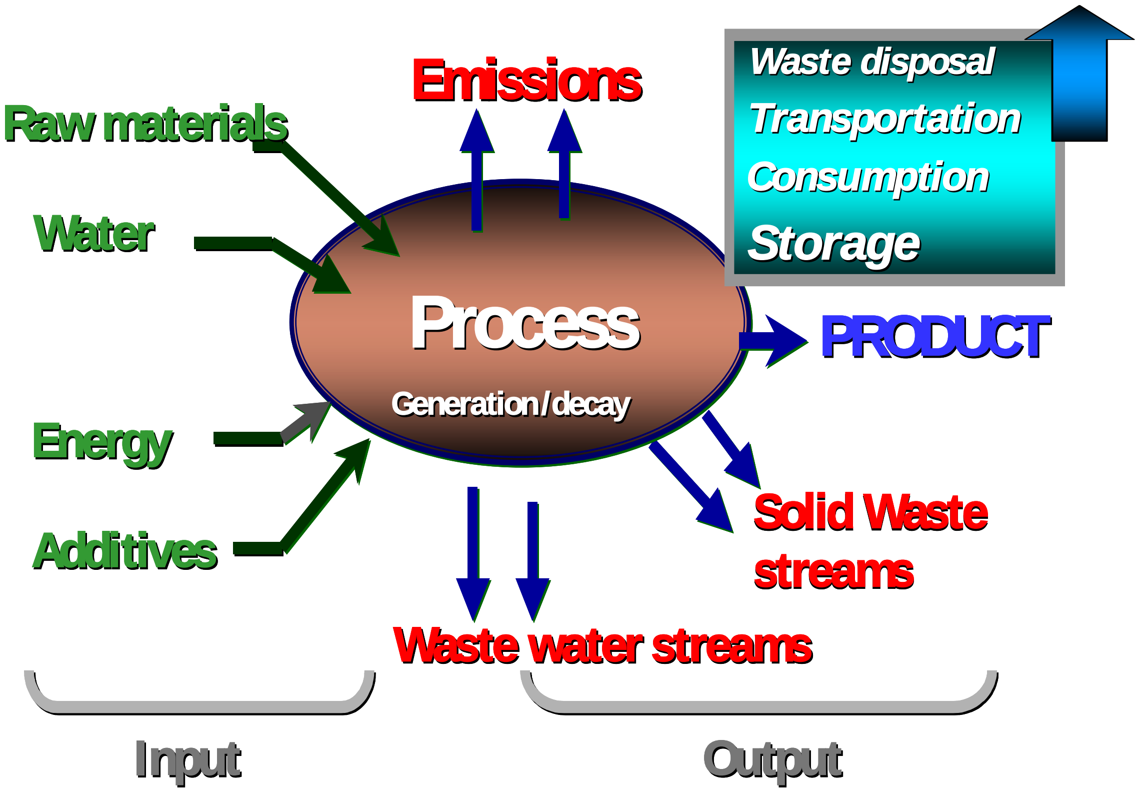
designing the CP technologies certain scientific elements and approaches are to be addressed and incorporated, including:

***Mass Balance Analysis (MBA)-*** involves tracking the materials (including energy, emission and wastes) in and out of an analysis area with specific boundaries such as a manufacturing station, a treatment plant or a watershed. Ideally, mass balances are based on measurements of inflows, accumulation/decay and outflows (including by-products and daughter products) over time. Materials can move between the anthropogenic-sphere and the natural environment in a closed-loop system (re-use for the same function) or an open-loop system (re-use for a different function). In tracing materials fate, it is important to set clear boundaries of mass measurements across media. Mass balance can be formulated as follows:

$$Rate \cdot of \cdot Change = Input - Output \pm Accumulation$$

Figure 1 depicts the potential elements of mass balance in an industrial process.

**Figure 1-Illustration of the Mass Balance Approach in an Industrial Process**

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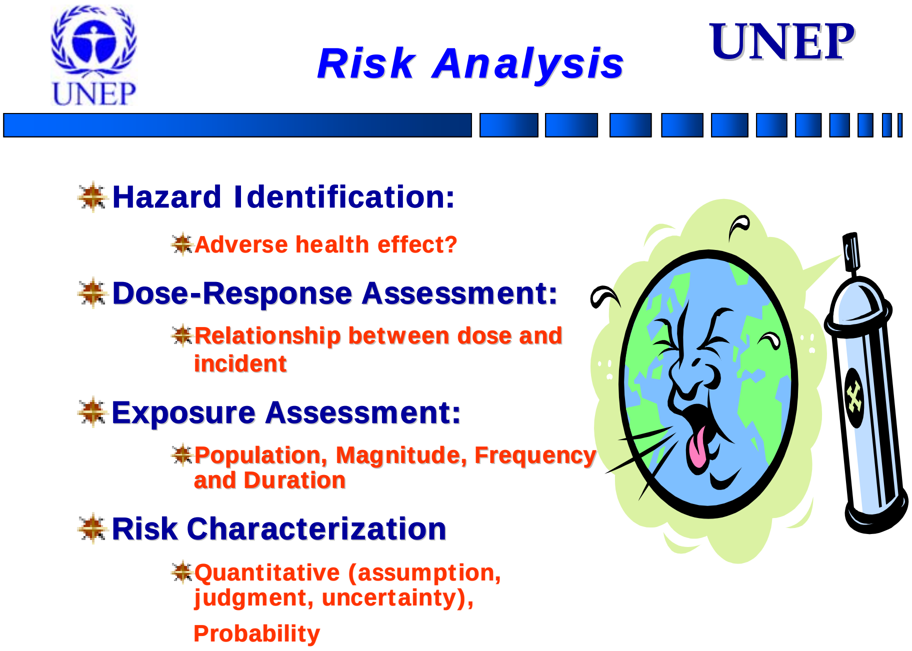
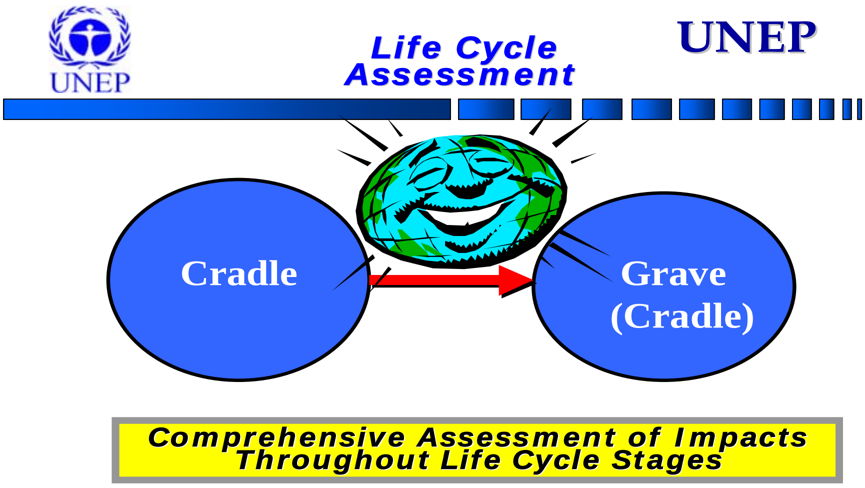
***Risk Analysis (RA)-*** is a probabilistic assessment of dose-response relationship, taking into consideration the fate and transport of constituents, routes of transfer, pathways of exposure, as well as the potential recipient population(s). The assessment of risk can be outlined in five major steps: hazard identification, dose-response assessment, exposure assessment, risk characterisation, and risk management (i.e., what level of risk is acceptable?). Risk analysis is a useful vehicle for integrating effects over several media (air, water and soil). However, uncertainties always exist in measuring or estimating risks, especially for relatively lower dosages but higher exposure frequencies. Also, extrapolation from animal studies and epidemic investigations is at best debatable. Distinction should be drawn between acute and chronic risks.




***Life Cycle Assessment (LCA)-*** is a technique for tracking all the environmental effects and resource needs of a new product or process through the material supply, manufacturing, transport, storage, use and disposal (and even beyond). It is intended to provide a comprehensive assessment of environmental effects to ensure that potential risks to health and environment at the various stages of life cycle are taken into account, and that appropriate measures are put in place to manage or reduce those risks. LCA assesses the overall environmental compatibility and synergy of an industrial product/process with the environment.

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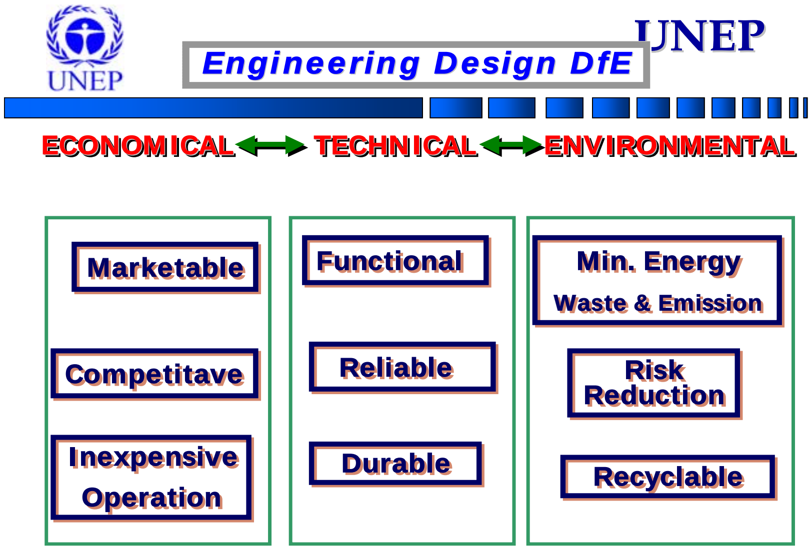
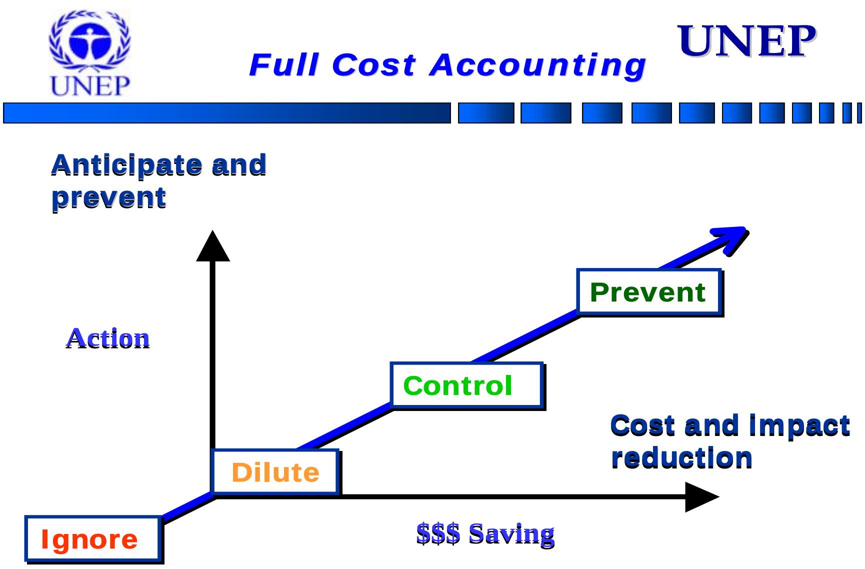
***Engineering Design (ED)-*** is often a complex process due to numerous competing requirements and constraints. For example, a personal computer must be fast and powerful and cheap, however to be environmentally “green” it should be energy efficient, and easily recyclable. Designing CP processes and manufacturing environmentally friendly products require appropriate knowledge, tools, production methods, incentives (e.g., public recognition, tax incentives, loan guarantees/facilitation, market accessibility) and commitments (namely from senior managements towards CP). Designers and engineers should be trained (retrained) to integrate the environmental perspective into their tasks. This sometimes is referred to as Design for the Environment (DfE) [(3)].

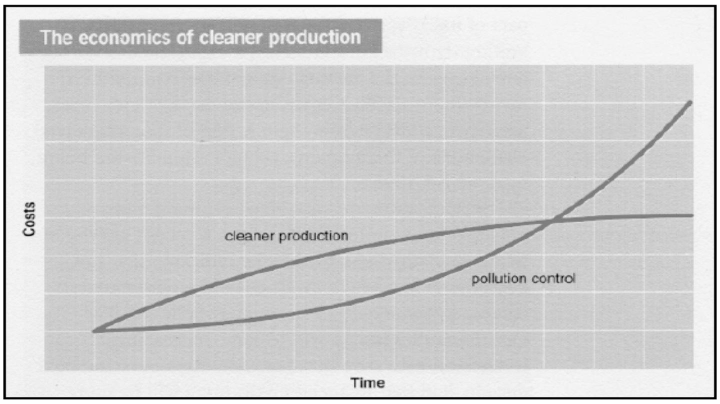



Another relevant term designated as Design for Disassembly and Recycling (DFD/R) has also evolved with the CP notion (i.e., making products that can be taken apart easily for subsequent recycling and parts reuse). For example, disposable (Kodak) cameras can be taken apart, allowing 87% of the parts (by weight) to be reused or recycled. Unfortunately, the economic expense associated with physically dismantling the product (to obtain the valuable components) often exceeds the value of such retrieved materials. Reducing the time and effort (and thus the cost) needed to disassemble a used camera should make the process more favourable economically in addition to its clear environmental advantage.

***Full Cost Accounting Methodologies (FCAM)-*** Simply, by incorporating environmental considerations into the process of determining actual costs. Many industries, governments and consumers want to support cleaner production and green products, but are afraid of the potential high costs incurred. The FCAM efforts are introduced to account for “hidden” costs related to social and environmental implications (e.g., resource depletion, damages, liability, injuries, cleanups...etc.). For example, when an engineer/designer is developing a machinery lubrication system, oil-based or glycol-based lubricants can be selected. Choosing the oil-based may increase the risk of water pollution and treatment difficulties, while choosing the glycol-based may increase the risk of human exposure



to synthetic chemicals. The FCAM would incorporate into the analysis the cost of water pollution versus the cost of dealing with health exposure. This information can be communicated by having a "social" cost of lubricants listed with the price tag. Another way would be by anticipating the costs of environmental management, damages, containments, and remediation due to treatment and disposal of the lubricants (within the LCA concept), and incorporating them into the FCAM system.




***Material Selection (MS)-*** several materials or components may produce a particular quality constituent, product or process. Selection guidelines can be established to direct the CP designer/developer towards the environmentally preferred material. In general, some common sense prerequisites are to be satisfied, such as:

- Choose abundant, non-toxic materials wherever possible.
- Select natural materials (e.g. cellulose), rather than man-made materials (e.g. chlorinated aromatics).
- Pick materials with decomposing characteristics and avoid those with persistent and recalcitrant tendency.
- Minimise the number of materials/elements used in a product or process.
- Use materials with an existing reuse/recycling infrastructure and market.
- Employ recycled materials as often as possible.

It is important to point out that collective considerations of the above concepts should also be incorporated and integrated into the materials selection processes, such as basing the decision of choosing natural versus synthetic materials upon their technological merits (ED) as well as LCA and FCAM.

## CP CHALLENGES AND SOLUTIONS

The challenge of CP is to alter conventional design and manufacturing procedures in order to incorporate environmental considerations systematically and effectively. This requires changes not only in these existing procedures, but also changes in the way people do things (which is the more difficult task). In order to achieve that, clear environmental concerns and objectives must be introduced and communicated on all levels (industry, institutions, governments, consumers…etc.). Education campaigns fortified by laws and regulations, and perhaps political commitment can overcome such obstacles.

The actual costs of change are often high, especially initially. Payback periods may also be longer than in alternative investment options. In the long term, however, investments in CP technologies can have attractive economic benefits not only due to the reduction of costs for materials, energy and water, and thus waste treatment, management and disposal, but also due to curtailing social, environmental and legal liabilities. Benefits returns can also be accelerated from increases in production and quality. Governments can facilitate this process by

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introducing policies and instruments (import tax reductions, special funds and credit windows for cleaner production, pricing of water and energy, etc.) that promote cleaner production solutions in the selection of technology for retrofits and new investment. Policies that prevent pollution tend to be more effective and cheaper in the long term than policies that induce the treatment and disposal of wastes that could be avoided [4,5].

Small and medium sized industries have a particularly difficult choice making CP investments for reasons that range from the cost of capital to the absence of appropriate funding mechanisms. Furthermore, CP options are likely to be economically less attractive in countries with few and/or un-enforced environmental regulations, under-priced or free natural or labour resources, and little consumer interest in products that are produced and consumed in a more environmentally responsible manner. Although the pressure of consumer movements in developing countries has so far had limited influence on decisions related to the choice of production technology, such pressure is likely to increase considerably in the upcoming years, “Greenifying” of the production process is already taking place with some multinational companies who extend such requirements to their supply chains in developing countries. With globalisation and the information revolution consumer demand for competitive products that are environmentally sound is also increasing rapidly. Cleaner production is after all a means to improve and manage industries image and reputation, promote efficiency and make the capital stock less environmentally damaging. Financial institutions have an interest in guiding their customers to positions that consider supply-side pressures, anticipated legislation, licenses and permits, and market trends. This is often a fast-moving arena[4,5].

Globalisation presents a major challenge to developing countries in their attempts to promote economically viable domestic and international investments, decisions that are generally based on financial criteria. Financial institutions and other sources of private sector funding follow a well-defined process of “due diligence” when evaluating loan and investment proposals. This process consists of verifying the technical, financial and legal aspects of the project, evaluating the creditworthiness of the borrower, and assessing the different potential risks involved. Environmental risks are often undervalued and the costing of inputs often favour less efficient options, particularly in developing countries. Consequently, projects incorporating local or national environmental benefits, and that might be good investments, fail to advance because of a misconception of the risks involved and misleading financial assessment. There is a need to develop financial and economic tools and instruments that correct this bias and address less tangible factors, such as avoided costs, compliance, training, liability, quality or products or corporate image. The time horizon needed to calculate a profitable payback period the long-term benefits should be stressed.

At the international level, mechanisms to transfer intellectual property rights to developing countries agents are needed in order to stimulate local production and commercialisation of CP. Developing countries can also make greater use of pollution prevention trade promotion tools to support investments in CP. This could include the proactive use of eco-labelling and participation in international standards programmes (e.g. ISO 14001). Developed countries need to eliminate escalating tariffs that prevent developing countries from moving up the production chain away from raw materials and commodities and towards products with substantial added value. This would allow developing countries to internalise environmental costs into export production.

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**EXAMPLES AND CASE STUDIES:**

Numerous examples of applying CP in various industries, manufacturing processes, waste management, and services can be presented; some practices are outlined herein for reference:

Solvent substitution- With due considerations to the technological characteristics and specifications merits, the use of often-toxic solvents (e.g., Cl-based solvents) are replaced by more benign alternatives (e.g., water-based solvents), including (but not limited to) biodegradable, non-toxic/less-toxic, water-based versus organic based solvents.

Resource-efficient technologies- Emphasise the use of renewable energy source or energy saving measures/programs to curtail consumption as well as emissions. Modifications can be incorporated into the various production/service areas (e.g., lighting, A/C...etc.) as well as machineries (e.g., automatic energy shut-off devices) This is also true for all natural resources utilisation to increase “Resource Productivity”. It has been stated: “The amount of wealth extracted from one unit of natural resources can quadruple. Thus we can live twice as well-yet use half as much[(6)]” .

Green Chemistry- Green Chemistry (GC) is a notion conceived from the larger concept of Cleaner Production (CP). It denotes the use of chemistry for pollution prevention. The mission is to promote innovative chemical technologies that reduce or eliminate the use or generation of hazardous substances in the design, manufacture, use, and/or ultimate disposal of chemical products. Green chemistry encompasses all aspects and types of chemical and petrochemical manufacturing processes that reduce negative impacts to human health and the environment in the framework of current state-of-the-art technologies. GC can be implemented by harnessing technical information on green synthesis, alternative additives and solvents, reaction conditions, and environmentally responsible chemical products. By reducing or eliminating the use or generation of hazardous substances associated with a particular synthesis or process, chemical/petrochemical industries can greatly reduce costs and liability, and improve earning and public image, while protecting human health, welfare and the environment.

Recycling/reuse of toxic wastes- Can prevent discharges of harmful materials into the environment, and avoid generating more hazardous wastes from continuous or other production processes. For example, rechargeable nickel-cadmium batteries can be recycled to recover both cadmium and nickel for other uses, or an acidic waste stream may be used to neutralise an alkaline stream. In some instances, hazardous waste components may have high economic values (e.g., heavy metals).

After providing general examples of potential CP applications, it is prudent to highlight some success stories of implementing CP technologies. These are plentiful and widely reported in different industrial sectors around the globe. Successes have been achieved by employing one or more of the CP environmental management elements: processes modification, apparatus redesign, raw material and packaging substitution, improving operation and housekeeping, monitoring spillage and leaks, energy and resource conservation, better recovery and recycling systems. Two specific case studies of

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variable background and from different industrial sectors are presented in the following sections to depict CP potentials, applicability and versatility.

**CASE: TEXTILES MANUFACTURING INDUSTRY[7]**

Background: This case study is an illustration of CP application in a textile company in Norway. The company processes about 850 tons of fabric per year. The main operations are colouring, washing, peroxide bleaching, drying and calendaring. The raw materials are mainly woven textiles, but also some yarn. The company has 54 employees and a yearly turnover of 5.7 million US Dollars.

Cleaner Production Application: The project aimed at the generation and implementation of cleaner production options. Mass balance analyses were conducted to propose improvements. The proposed CP measures involved process changes and process control actions.

The process modifications opportunities include:

1. Improving the dying process by using pigments that give improved absorption and lower effluents.
2. Reduction in labour carriers during production, and introduce automation measures.
3. Investing in a new air-flowing machine to save in pigment consumption and chemicals use. The new machinery would also result in savings in labour and increased production capacity.
4. Investing in the expansion of the wash installation capacity to save water and energy.
5. Lowering the wastewater variations in terms of flow and organic loads.
6. Centrifuging the textiles before drying.
7. Developing a recycling system to reduce waste disposal and costs.
8. Introducing recyclable packaging.

The process monitoring Procedures were:

1. Monitoring of water consumption through installation of an automated system.
2. Compiling records of the chemicals in use.
3. Registering loss of finished product.

Recovery, reuse and recycle measures were:

1. Recovering of cooling water from the jet machine.
2. Sewing together and selling remainders and end cut-offs.
3. Ordering buckets to collect dry-cell batteries.
4. Recycling office paper to reduce waste costs and conserve the resources.

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Implementation: All the modification, monitoring and recovery opportunities were carried out. The option of lowering COD values, through reducing variations in the effluent water is of a special interest, and was implemented as well. The main source of organic COD load in the wastewater effluent is the pre-treatment of the raw materials. The raw materials handled by the company contain soluble and suspended organic substances (cotton fibres, wax and pectin; starches, PVA...etc.). There are two ways to reduce the organic substances in the effluent wastewater:

1. Recovery of some of the organics from the effluent through ultra-filtration or electro-flocculation.
2. Exploring the availability of raw material with low contents of soluble organic substances. This option was eventually implemented, since the first one is technically complicated and costly.

Environmental and Economic Benefits:

- The proposed options had no major effect on the product quality or marketability.
- Reduced the use of pigment and chemical consumption by about 10 percent.
- Energy consumption was reduced by about 15%.
- The wastes were reduced by about 15%.
- Wastewater volume was reduced by 12%.
- COD wastewater load was reduced by about 20%
- $CO_2$ and $SO_2$ emissions ere reduced by about 15%.

**Table 1 Summary of the Textile Industry Case Study Environmental Results**

| | **Before** | **After** |
|---|---|---|
| Amount of waste water, $m^3$/yr | 80,750 | 71,100 |
| COD max. Measured value mg/L | 1000 | 800 |
| Consumption of fuel oil, tons/year | 606 | 515 |
| Emission to air, SO2 tons/year | 1.55 | 1.32 |
| Emission to air, C02 tons/Year | 1,909 | 1.623 |
| Waste, tons/year | 66.5 | 57 |

The payback time for implementing the CP technology and complementing options is about 3 years.

**CASE: CEMENT MANUFACTURING INDUSTRY**

The Cement Industry is one of great interest with regard to CP, due to its economic importance, contribution to human development and societal advancement, as well as polluting potentials.

Background Cement manufacturing is an energy intensive process in which cement is made by grinding and heating a mixture of raw materials such as limestone, clay, sand, and iron ore in a rotary kiln. The process of Portland cement manufacture consists of:

1. Quarrying and crushing the raw materials,
2. Grinding the carefully proportioned materials to a high degree of furnaces,
3. Pyro-processing the raw mix in a rotary kiln to produce clinker, and
4. Grinding the clinker to a fine powder along with the appropriate proportion of gypsum to produce cement.

There are two types of cement processes, the wet process and the dry process. Newer designs of dry process plants are equipped with innovations such as suspension preheaters or precalciners to increase the overall energy efficiency of the cement plant.

The kiln, a large furnace, is usually fuelled by oil, gas, coal, coke and/or various waste materials. The product (called clinker) from the kiln is cooled, ground, and then mixed with a small amount of gypsum to produce what is known as the Portland cement. Some cement kilns may burn hazardous waste, thus they should be covered under air toxic standards and guidelines for hazardous waste incinerators.

Toxic emissions (dioxins/furans and polycyclic organic hydrocarbons) can be driven from the cement plant kiln. Emissions originate from the burning of fuels and heating of feed materials. Air toxins are also emitted from the grinding, cooling, and materials handling steps in the manufacturing process. Emissions of particulate matter may also contain toxic metals (such as cadmium and chromium), from kilns and clinker coolers. Particulate matter concentration can be measured by opacity (a surrogate pollutant for particulate matter and toxic metals). Minimisation of hydrocarbon emissions can be achieved through the CP and $P^2$ technique, such as using clean feed materials; however, particulates are usually captured by air pollution control equipments and “end-of-pipe” treatment mechanisms, e.g., filters, electrostatic precipitators, cyclones…etc.

Most cement plants are equipped with particulate collection devices to remove cement kiln dust (CKD) from the kiln exhaust gases as well as clinker cooler gases. Several small dust collectors are also installed at various dust emission points such as crushing and grinding operations. The collected CKD is usually recycled with the feed or injected at different points in the kiln depending upon the quality and source of the CKD.

NOx and Photochemical Smog and OZONE [8] Oxides of Nitrogen are known to occur as NO, $NO_2$, $NO_3$, $N_2O$, $N_2O_3$, $N_2O_4$, and $N_2O_5$, the only two that are important in air pollution are Nitric Oxide (NO) and Nitrogen Dioxide ($NO_2$). NO can oxidise to $NO_2$, which in turn may react with hydrocarbons in the presence of sunlight to form photochemical smog. Ozone ($O_3$) is the most abundant Photochemical Oxidants. The overall reaction can be presented as:

$$\textbf{Hydrocarbons + NOx + Sunlight} \dashrightarrow \textbf{Photochemical Smog}$$

Or;

$$N_2 + O_2 \dashrightarrow 2NO$$
$$2NO + O_2 \dashrightarrow 2NO_2$$

In the presence of sunlight (i.e., presence of Photon, *hv*)

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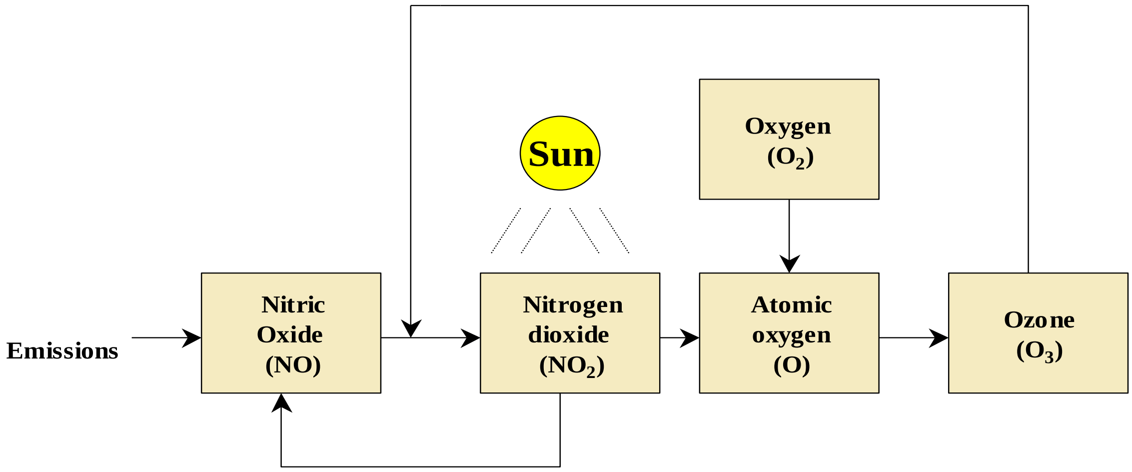
$$NO_2 + h\nu \dashrightarrow NO + O$$
$$O + O_2 + M \dashrightarrow O_3 + M$$

M represents a molecule in the air (e.g., $O_2$, $N_2$...)

Ozone can then convert NO back to $NO_2$, and the loop is repeated. The nitrogen dioxide photolytic cycle is also expanded to include hydrocarbons, which explain the increase in ambient air Ozone concentrations above what would be predicted by the $NO_2$ cycle alone. Furthermore, $NO_2$ reacts with hydroxyl radical (OH) in the atmosphere to form nitric acid ($HNO_3$), which is washed out as acid rain. The following Figure 2 depicts the health and environmental impacts of NOx.

## Simplified atmospheric nitrogen photolytic cycle

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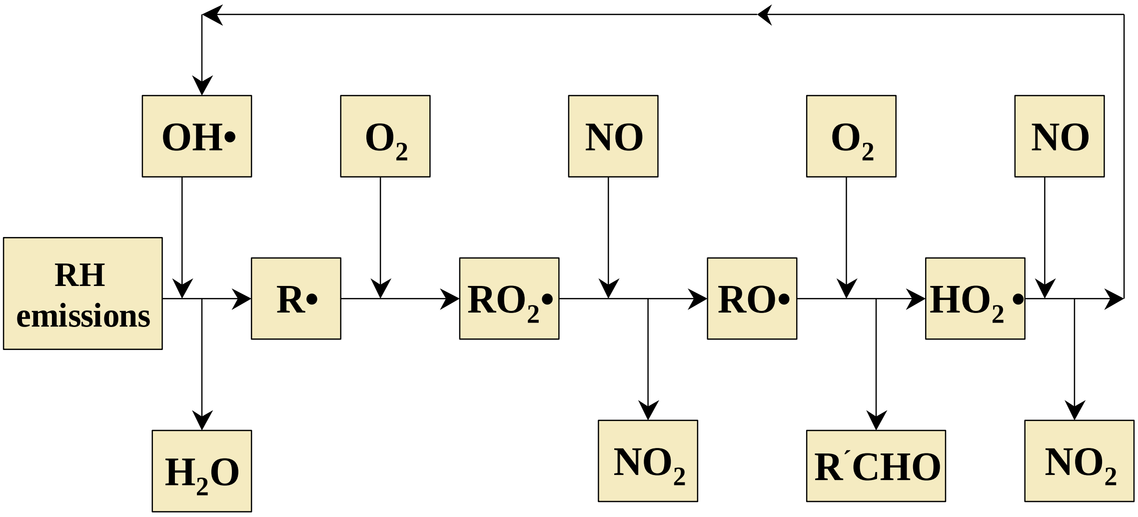
***One way that hydrocarbons can cause NO to convert to $NO_2$. Reducing NO slows the removal of $O_3$, while increasing $NO_2$ increases the production of $O_3$, so this cycle, when combined with the previous figure, helps account for elevated atmospheric $O_3$ levels.***




<u>NOx in the Cement Industry</u>- In cement manufacturing, conditions favourable for formation of nitrogen oxides (NOx) are reached routinely because of high process temperatures. Essentially all NOx emissions associated with cement manufacturing are generated in cement kilns. In cement kilns, NOx emissions are formed during fuel combustion by two primary mechanisms:

- Oxidation of molecular nitrogen present in the combustion air which is termed thermal NOx formation, and
- Oxidation of nitrogen compounds present in the fuel is termed fuels NO formation.

Often the raw material feed to the kiln may also contain a significant amount of nitrogen compounds, leading to exacerbate NOx formation. High temperatures involved in the burning provide the dominant mechanism for NOx formation in cement manufacturing. The term NOx includes both NO and $NO_2$ species, although $NO_2$ normally accounts for less than 10 percent of the NOx emissions from a cement kiln exhaust stack. The concentration and emission of NOx are, however, typically pressed in equivalent $NO_2$.

The equilibrium concentrations of NO and $NO_2$ formed depend strongly upon the gas-phase temperature as well as the concentration of $O_2$ and $N_2$ in the gas phase. The excess air used during fuel combustion can substantially affect NOx formation by determining the amount of oxygen available for reaction.

Furthermore, it is important to point out that the greater the amount of fuel and feed nitrogen, the greater the fuel NOx emissions. Therefore, reducing the amount of fuel and feed-bound nitrogen will reduce the contribution of the fuel and feed NOx. For any given type of kiln, the amount of NOx formed is directly related to the amount of energy consumed in the cement-making process. Thus, measures that improve the energy efficiency of this process should reduce NOx emissions in terms of Kg of NOx /ton of product. With the rising costs of energy and the very competitive cement market, greater attention is being paid to reduce over-burning of clinker, improving gas-solids heat transfer and increasing overall energy efficiency. This is a

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clear application of CP. Continuous emissions monitoring of CO, NOx, and $O_2$ provide an indication of clinker burning conditions and also provide an input for process control.

There are four different types of cement kilns used in the industry: long wet kilns, long dry kilns, kilns with a preheater, and kilns with a precalciner. The long wet and dry kilns and most preheater kilns have only one fuel combustion zone, whereas the newer precalciner kilns and preheater kilns with a riser duct have two fuel combustion zones. Since the typical temperatures in the two types of combustion zones are different, the factors affecting NOx formation are also somewhat different in different kiln types. In a primary combustion zone at the hot end of a kiln, the high temperatures lead to predominantly thermal NOx formation, whereas in the secondary combustion zone lower gas phase temperatures suppress thermal NOx formation. In addition, to the specific NO formation mechanisms, the energy efficiency of the cement-making process is also important as it determines the amount of heat input needed to produce a

Unit quantity of cement: A high thermal efficiency would lead to less consumption of heat and fuel and would produce less NOx emissions. Newer cement kiln designs are generally based on preheater/precalciner systems that provide very efficient gas-solids contact and greater energy efficiency.

NOx control approaches applicable to the cement industry may be grouped in two categories:

- Combustion control approaches where the emphasis is on reducing NOx formation (CP approach), and
- Post-combustion control approaches to control the NOx formed in the combustion process.

Process control approaches (as CP) are based upon providing optimum kiln operating conditions that increase the energy efficiency and productivity of the cement-making process while minimising NOx emissions. Such measures will provide a baseline of emissions in cement kilns without any specific NOx control equipment.

The combustion control approaches for reduction in NOx formation can be summarised as:

1. Combustion Zone Control Of Temperature And Excess Air (i.e., Optimisation),
2. Processes Modifications, such as [10]:
   - Feed Mix Composition Change: If the raw feed composition can be formulated to require less heat input per ton of clinker, less fuel is burned and less NOx is produced. Accordingly, reducing the alkali content of the raw feed mix reduces NOx emissions.
   - Kiln Fuel Change: Switching to a fuel with a higher heating value and lower nitrogen content should reduce NOx emissions in a cement kiln, e.g., petroleum coke has a lower nitrogen content per million Btu than coal. The petroleum coke is also more uniform in terms of heat value, lower in volatile matter content and burns with a lower flame temperature.
   - Increasing Thermal Efficiency: The thermal efficiency of the cement-making process may be increased by improving gas/solids heat transfer, e.g., using an efficient chain system, increasing heat recovery from clinker cooler, and by minimising infiltration of cold ambient air leaking into the kiln.
3. Staging Combustion Air, Low NOx Burner, and Flue Gas Recirculation:

   In the first stage, fuel combustion is carried out in a high temperature fuel-rich environment and the combustion is completed in the fuel-lean low temperature second stage. The formation of NOx is thus minimised in spite of the excess available oxygen in the second zone. This approach can be used for combustion of all fossil fuels. The so-called low-NOx burners are designed to reduce flame, turbulence, delay fuel/air mixing, and establish fuel-rich zones for initial combustion. By controlling the available oxygen and temperature, low NOx burners attempt to reduce NOx formation in the flame zone. The oxygen content of the primary air may be reduced by recycling a portion of the flue gas into the primary combustion zone. Coupling a low-NOx step burner with flue gas recirculation has been shown to reduce NOx emissions further in a cement kiln.

4. Secondary Combustion Fuel: Another technique for NOx reduction is the secondary combustion of fuel in conventional kilns (by "mid-kiln" firing). In the secondary combustion concept, part of the fuel is burned at a much lower temperature in a secondary firing zone to complete the preheating and the calcinations of the raw materials. Secondary combustion of fuel is inherently present in all precalciner kilns and preheater kilns.

The Post-combustion control approaches for reduction in NOx formation during combustion can be summarised as[(10)]:

1. Selective catalytic reduction (SCR): This method uses ammonia in the presence of a catalyst to selectively reduce NOx emissions.
2. Selective noncatalytic reduction (SNCR): This technology appears to be applicable to preheater/precalciner type kilns. SNCR reduces NOx with ammonia or urea without a catalyst. SNCR is not considered applicable to long wet and dry kilns due to difficulties involved in continuous injection of reducing agents. Molar reagent ratio, temperature, and gas residence time in the appropriate temperature window are primary factors affecting NOx reduction efficiency.

**Table2 NOx Reductions by Various Techniques in Cement Manufacturing[(10)]**

| Technique | % NOx Reduction |
|---|---|
| **Process modifications** | **<25** |
| **Conversion to a low-NOx burner** | **20-30** |
| **Staged combustion kilns** | **30-45** |
| **Mid-kiln firing in long kilns** | **20-40** |
| **SNCR Kilns** | **30-70** |
| **SCR Kilns** | **80-90** |

## REGIONAL CASE: TYRES MANUFACTURING INDUSTRY

Background: Transport and Engineering Company (TRENCO) is an Egyptian public sector company producing 22,000 tons of car tires per year.

During the manufacturing process the tires are sprayed from inside and outside with a mixture of chemicals containing natural rubber, synthetic rubber, carbon, stearic acid, paraffin oil, and non-oxidising agent, all dissolved in organic solvents (heptane) to facilitate spraying of the mixture. This is a routine process to strengthen durability and weathering resistance of the

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manufactured tires. Before the project, the process consumed 56 tons of spray annually. Approximately 77% of the mixture was aliphatic heptane.

The spraying booth used for the manual spraying was not equipped with appropriate suction system and the heptane concentration in the occupational term exceeded the limits for heptane, 400 ppm and 500 ppm for average and short-term exposure respectively.

CP Project: The objective was to reduce heptane concentration in the work environment by performing automatic spraying in a closed area. In addition, the solvent-based mixture was replaced by water-based mixture in the internal tire spraying process.

Technical Assistance of this project was financed through a grant from the government of Finland; an international consultant was assigned to carry out an environmental audit, which confirmed the environmental benefits associated with this project.

The new project with investment cost (US$ 469,000) was financed through EPAP by a soft loan package from World Bank with (20% grant and 80% loan). The new project has been in operation since September 2000.

Environmental Benefits: Partial conversion to water-based spray leads to a significant reduction of the consumption of the heptane. The automatic spray booth with efficient suction prevents the workers form hazardous exposure to heptane.

The self-monitoring results after commissioning of the project confirmed these benefits. The amount of heptane used per tire was reduced from 0.1 litre/tire to 0.05 litre/tire (50% reduction). The average concentration of heptane recorded all over the year in the work environment was 130 ppm. This is about 30% of the allowed limit.

Economic Benefits: The new automatic spray booth resulted in replacing the solvent-based spray used for the inside spraying with water based spray. Consequently, a significant decrease in the use of the solvent-based compounds by 50% was achieved, which resulted in saving 40,000 L.E. annually.

### REGIONAL CASE: FLUORESCENT LAMPS MANUFACTURING INDUSTRY

Background: NEEASAE is a public sector company, mainly producing fluorescent lamps in Egypt. The maximum yearly production capacity is about 11 million lamps from different types.

Liquid mercury (Hg) is used in the production process of fluorescent lamps. The production process includes flushing of mercury, removal of impurities, and then filling with an inert gas (e.g. Argon or other gases depending on type of lamp).

The mercury flushing causes emissions into the work environment. Mercury vapour concentrations has reached 0.25 mg/m$^3$, the maximum limit set by the Egyptian Environment law is 0.05 mg/m$^3$.

The total consumption of mercury was 76.92 kg per 1 million lamps and the estimated pollution load was 400 kg of hg per year.

CP Project: The project implementation aimed at the protection of workers health by reducing the exposure to mercury vapour. This was achieved by adopting a leaner production solution consisting of replacing mercury flushing of lamps by flushing argon. But still Mercury is used in the lumps, about 15-20 mg. Per lamp since it is an essential element in emitting light (this amount is dosed in complete insulted environment, assuring no contamination t the working

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environment). The project succeeded in reducing the amount of mercury used per lamp from 76.92 kg/million lamps to 20 kg/million lamps.

Technical Assistance was financed by a grant from the government of Finland. An international consultant was assigned to prepare a Pollution Abatement Action Plan to support the company in acquiring the ISO-14001 environmental management certificate.

The new project with investment cost (200,549 US dollars) was financed through EPAP by a soft Loan package from the World Bank (20% grant 80% loan). The commissioning of the project was in September 2000; the company if following strictly the self-monitoring plan agreed with EPAP and maintenance plans recommended by the supplier. EPAP has finalised post completion report for this company in December 2001.

Environmental Benefits: Current measurements in the work environment are shown in the following table, which compares the concentrations and loads of mercury before and after the implementation of the project.

| Pollutant | Before project | After project | Tech. agreement | Environmental Legislation |
|---|---|---|---|---|
| Mercury emissions | 0.25 mg/$m^3$ | 0.01 mg/m3 | <0.05 mg/$m^3$ | 0.05 mg/$m^3$ |
| Mercury load | About 0.4t/year | About 0.016 t/year | About 0.04 t/year | |
| Amount of mercury used per $10^6$ lamp | 76.92kg/$10^6$/lamp | 20 kg/$10^6$ lamp kg/$10^6$lamp | 23.08 kg/$10^6$ lamp | |

Economic Benefits: A cost benefit analysis was conducted which proved that there is no monetary benefit associated with this project per se. However, there are reduced health care costs. Also the availability of argon locally is of great benefit since this implies savings in foreign currency required for importing mercury.

Cleaner production applications in various industries are numerous; nonetheless this paper has presented two examples from the Textile and Cement manufacturing industries. Applying the CP is undoubtedly beneficial in terms of protecting human health and the environment, conserving precious resources (including energy), complying with regulations, improving the image, and strengthening the competitive edge in the tight cement market.

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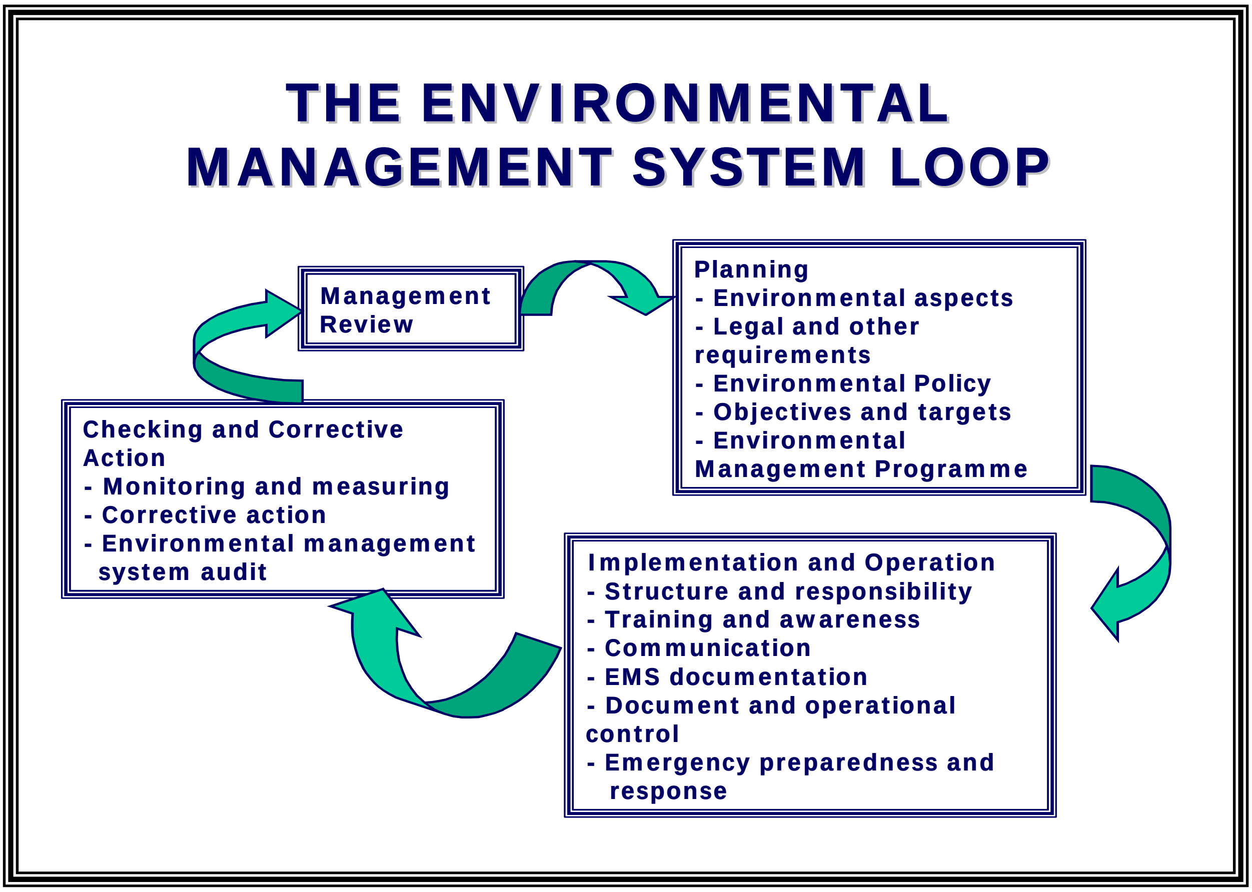
## ENVIRONMENTAL MANAGEMENT SYSTEMS

One approach to ensuring efficiency in industrial processes is the implementation of an Environmental Management System (EMS), addressing all aspects of an organisations' activities, including raw materials consumption, energy, process control, waste and emissions. The following section aims to outline the approach to the successful implementation of an EMS, taking into consideration all aspects, including management commitment, resourcing and training.

An EMS is a comprehensive approach to the environment that encourages and sustains an organisational structure and procedure for developing, implementing, achieving, reviewing and maintaining an effective environmental policy. An EMS operates in a similar manner to other management systems implemented by an organisation (financial, health and safety, quality), following the Deeming Cycle of Plan-Do-Check-Act for continuous improvement. It systematically addresses the immediate and long-term impacts that an organisation's processes, products, services and operations can have on the environment. Figure 1 below provides an illustration of the continuous improvement loop used in EMS.

**Figure 1: The Continual Improvement Loop of an Environmental Management System**

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## Management commitment and the environment team

Without the commitment of the top management of an organisation to the implementation of an EMS, it is unlikely to succeed. Their commitment is necessary in securing resources (human, financial and technical) and in promoting the process – if an employee sees that the management of their organisation is not committed/interested in the success of the system, then there is no reason for them to extend any effort themselves.

Another key aspect in terms of management/organisational support to the EMS is the formation of an Environment Team, the members of which are provided with the time and the resources to oversee the implementation of the EMS.  This team should comprise an Environmental Coordinator/Manager, who has access to the decision-makers of the organisation in order to present and promote solutions identified though the development and implementation of the EMS, supported by staff members from the key activities within the organisation, including administration functions (accounting or purchasing), facilities and maintenance, and each major department.  Within the Environment Team there may be sub-teams with particular areas of expertise, such as energy or waste, to deal with specific parts of the EMS as it develops.

### *The key stages of an Environmental Management System (EMS)*

## The Environmental Review

Before an organisation can plan and implement its environmental policy, an initial environmental review needs to be made. This review will provide an overview of the environmental issues a company is facing. The organisation then knows the strengths and weaknesses of its present operations and its management systems.

The information collected will include:

- Current environmental management activities;
- Environmental aspects of each part of the operation;
- Inputs, throughputs and discharges; and
- Monitoring.

**INITIAL ENVIRONMENTAL REVIEW**

- **Top management commitment confirmed**
- **Formation of an Environment Team**
- **Information to collect in the review will include:**
  - ✓ **what are the inputs, throughputs and discharges?**
  - ✓ **what environmental management is currently in place?**
  - ✓ **what are the environmental aspects of each part of the operation?**
  - ✓ **what do we currently monitor?**

For example, in terms of energy this will involve a thorough review of energy consumption and use, starting at the utility meters, locating all energy sources coming into a facility and then identifying energy streams for each fuel.  It will quantify those energy streams into discrete functions, evaluate the efficiency of each of those functions, and identify energy and cost saving opportunities. This information is used to analyse operational characteristics, calculate energy benchmarks for comparison to industry averages, estimate savings potential, set an energy reduction target, and establish a baseline to monitor the effectiveness of implemented measures. Required information includes:

- Copies of all monthly utility bills (for all meters) and delivered fuel invoices;

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- Sorting of utility bills by building or by meter and their organisation into 12-month blocks using the meter-read dates;
- Location of all meters and sub-meters. If numerous meters are used they should be labelled on a site plan; and
- Determination of which functions and areas are served by which meter.

A similar detailed review should be carried out for all aspects of the operation including raw materials use, waste, emissions to air and water. Annex 1 provides a sample questionnaire, which could be developed for carrying out an initial environmental review in an organisation.

**The Registers of Environmental Aspects and Regulation**

In the planning stage, all of an organisation's interactions with the environment are identified through the environmental review. The Register of Environmental Aspects is a formal listing of the operations activities carried out by the organisation that have an impact on the environment (the "aspects). To provide some definitions:

Environmental impacts are defined as "any change to the environment, whether adverse or beneficial, wholly or partially resulting from an organisation's activities, products or services"

Environmental aspects are defined as "elements of an organisation's activities, products or services that can interact with the environment".


For example, a key local environmental issue is local air quality. An activity that impacts on local air quality is the emission of particulate matter from a cement works, i.e. the environmental aspect of the operation is the process releasing particulates to the atmosphere, the environmental impact is the deterioration in local air quality. This impact can also have direct implications for human health, affecting breathing and exacerbating asthma and other bronchial conditions.

Another important aspect of any operation's activities is the consumption of electricity. Electricity consumption is therefore an environmental aspect, with the use of non-renewable resources and emission of $CO_2$ (contributing to climate change) and $NO_x$ and $SO_x$ (contributing to acid deposition) from power generation representing the environmental impact.

Table 2 below takes the example of the manufacturing, sale and disposal of a ballpoint pen to broadly illustrate the environmental aspects and impacts during its life cycle (i.e. from cradle to grave).

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**Table 2: Environmental Aspects/Impacts through the Life Cycle of a Ball Point Pen**

| Activity | Environmental Aspect | Environmental Impact |
|---|---|---|
| Obtaining the raw materials | Extraction of oil | ▪ Natural resource depletion<br>▪ Potential water contamination<br>▪ Ecological habitat damage |
| Obtaining the raw materials | Extraction of metals | ▪ Natural resource depletion<br>▪ Potential water contamination<br>▪ Ecological habitat damage<br>▪ Visual intrusion |
| Manufacturing the plastic feedstock | Energy consumption | ▪ Greenhouse effect<br>▪ Local air quality<br>▪ Noise |
| Manufacturing the plastic feedstock | Use of chemicals/ solvents | ▪ Potential air and water contamination<br>▪ Local air quality |
| Manufacturing the pen | Energy consumption | ▪ Greenhouse effect<br>▪ Local air quality<br>▪ Noise |
| Packaging the pens | Energy consumption<br>Paper and card | ▪ Greenhouse effect<br>▪ Local air quality<br>▪ Ecological habitat damage |
| Transporting the pens | Energy consumption | ▪ Greenhouse effect<br>▪ Local air quality<br>▪ Noise |
| Disposal of the pens | Landfill | ▪ Ecological habitat damage<br>▪ Visual intrusion<br>▪ Waste burden |

Sheldon & Yoxon, 2002[11]

The Register of Legislation provides a breakdown of the environmental regulations and legislation by which the organisation and its operations are bound. The minimum requirements of an EMS must be that the organisation operates within the legislative requirements placed upon it by its regulatory authority.

The Register indicates the organisation’s status with respect to the laws by which it is bound, whether it is in compliance and if not what measures are being taken to ensure compliance and by what date, and what special arrangements have been made (e.g. special licence) with the regulatory authority in cases of non-compliance. By maintaining and updating this Register, and keeping abreast of regulatory developments, it will possible for the organisation to ensure compliance and plan ahead to have a proactive response to regulatory changes, particularly the tightening of legislation with respect to emissions to air, land and water.

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## Development of an Environmental Policy

The environmental policy of an organisation should contain a commitment to comply with all environmental regulations, to prevent pollution and to initiate a process of continuous improvement. Each environmental policy is unique to the organisation to which it belongs. It must be communicated to all members of the organisation and made available to the public.


The environmental policy is the basis for developing a consistent structure of environmental objectives and targets for an organisation. The policy is designed to correct any adverse environmental impact and to encourage all practices that are beneficial to the environment. Strategic and competitive considerations are taken into account, so that companies can implement the best technology, within certain economic considerations, in order to reach their environmental objectives. Processes, practices, materials, or products that avoid, reduce or control pollution, which may include recycling, treatment, process changes, control mechanisms, efficient use of resources and material substitution, form key components of environmental policies.

The policy must be approved by, and signed by, top management in the organisation, demonstrating their commitment to the policy and the EMS as a whole.

## Setting Objectives and Targets

Once the baseline review has been carried out to identify the key aspect and impacts of an organisation, and the policy has been set, a series of objectives and targets are identified to minimise the organisations impact on the environment.


The overall objectives will be a broad statement of intent, with targets being time-specified steps to achieve the objective. The targets identified should be **SMART**, i.e. **S**pecific, **M**anageable, **A**chievable, **R**esult-oriented/Realistic and **T**imebound. Without taking these factors into account, the success of the EMS will be hampered.

The development of objectives and targets follows a systematic methodology that focuses on the big-cost areas, which, in turn, provide the greatest economic opportunities, tackling the "quick fix" and the large savings first. Often, addressing "housekeeping" leads to instant cost savings, the revenue of which can be re-invested in more complex solutions that may require some initial investment prior to reaping the longer-term cost savings.

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For example, an overall policy objective of an organisation might be the phasing out of hazardous substances used in production processes. During the Initial Environmental Review it might have been identified that a number of paints are being used which are based on solvents due to be banned in the near future. A specific target might therefore be to substitute water-based for solvent-based paints in (named process) by (target date).

Anther example might be an overall commitment/objective of reducing emissions to air. During the Initial Environmental Review, emissions of ethylene noted that are close to that allowed in the operating licence. A specific objective might be to reduce the annual emission of ethylene to 50% of that allowed in the current (2004) operating licence by (target date).

Targets can be in terms of direct improvements, maintenance or research, examples of each are provided in Table 2 below.

**Table 2: Examples of Types of Targets**

| Target Type | Example |
|---|---|
| Improvement | Reduce annual emissions of particulate matter by 25% over a two-year period. |
| Maintenance | Comply with all current and future regulations particulate emissions, monitor emission levels continually, maintain management procedures for filter maintenance and other management approaches and review abatement technology options on an annual basis. |
| Research | Conduct a company wide review of current methods of particulate reduction and research potential alternatives with a view to reducing emissions. |

after Sheldon and Yoxon, 2002[11]

Monitoring programmes are necessary in order to identify the success of the objectives and targets. This involves the regular collection of relevant data to determine progress made, ensuring that all equipment and techniques are subject to quality control to ensure valid results.

## The Environmental Management Programme

The Environmental Management Programme assigns responsibilities and identifies the means and time frame by which targets will be achieved. It is in effect the "how to" part of the EMS. The management, as part of their commitment to process, must provide the resources essential to achieving these targets including human resources and specialised skills, technology and financial resources.

## Implementation of the EMS

IN order to achieve the objectives and targets set, a number of documented procedures will be necessary. These represent the doing (and ensuring people are adequately to do) part of the EMS. This includes:

- Operational Control Procedures and Emergency Response and Preparedness Procedures (including document control procedures)
- Roles and Responsibilities
- Training Requirements

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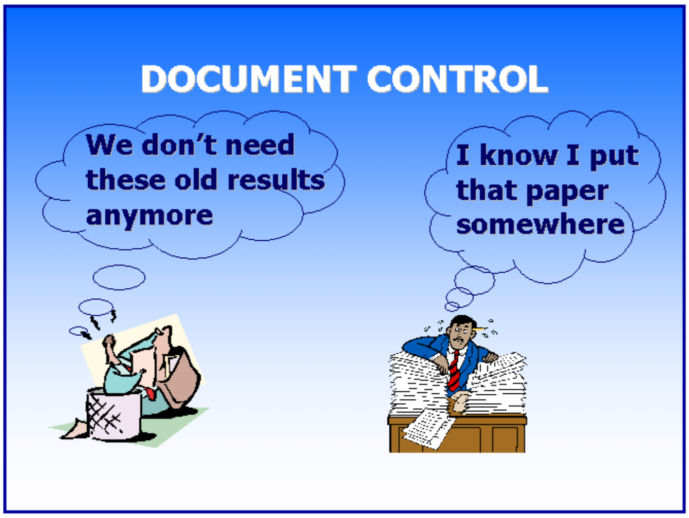
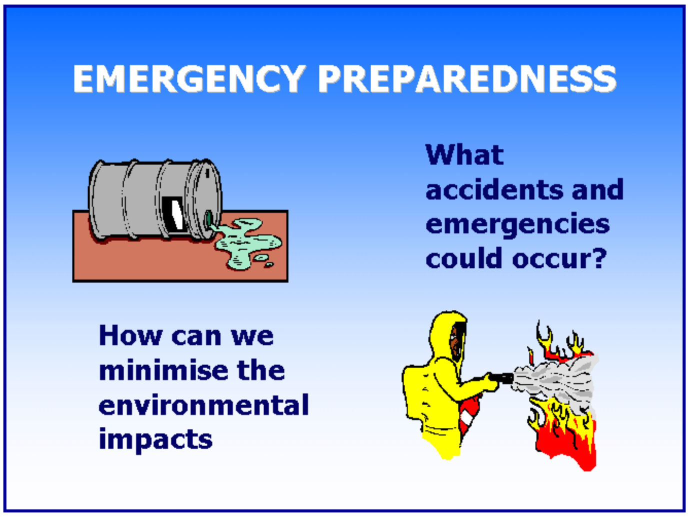
### *Documentation*

The EMS must be well documented. This documentation includes a description of the basic elements of the system and their interaction. There also needs to be documentation concerning operational control i.e. the procedures and work instructions needed to make sure that the environmental effects are managed. The organisation must also identify the potential for accidents and emergency situations (emergency preparedness) and develop appropriate procedures to respond to these, always emphasising health and safety as the primary concern when dealing with accidents and emergencies.



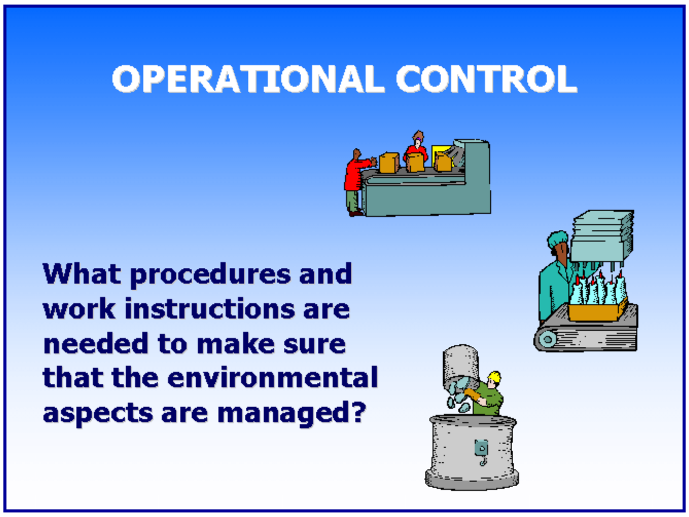




### *Roles and responsibilities*

The roles and responsibilities of personnel whose activities have an impact on the environment are defined, documented and communicated to all members of the organisation. These definitions are important to the effective implementation of an EMS, avoiding a situation of everyone assuming someone else is undertaking a specific task or too many people approaching a task from a number of different angles.

### *Training and Communication*

Through education and training, organisations learn to appreciate many of the potential benefits of pollution prevention: reduction of adverse environmental impacts, improved efficiency and reduced costs. All personnel with a significant contribution to environmental performance need to be adequately trained to handle the environmental aspects of their activities, enabling them to be

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competent in performing their tasks on the basis of appropriate education, training, and/or experience.

Raising the environmental knowledge base throughout the organisation can have great dividends. An EMS will operate much more effectively if an organisation understands the complexities of the issues and particularly the potential for economic benefit. The quality and quantity of employee suggestions will also improve significantly with training. Educational training should be considered for management, the environment team and all employees.

**COMMUNICATION AND TRAINING**

**Communication should be 2 way; and both internal and external.**

| INTERNAL | EXTERNAL |
|---|---|
| Training<br>Informal awareness raising<br>Notices<br>Newsletters<br>Feedback | Environmental reports<br>Newsletters<br>Open days<br>Presentations<br>Feedback |

Employees are often the greatest untapped resource in an EMS. A structured method of soliciting their ideas can prove to be the most productive effort of the EMS. Too often employee involvement is limited to posters that say, for example, "Save Energy" or "Save Water". Employees in manufacturing plants generally know more about the equipment than anyone else in the facility because they operate it. They know how to make it run more efficiently, but because there is no procedure in place for them to have any input, their ideas go unsolicited.

The key to a successful EMS is ownership, and this should extend to everyone within the organisation. Employees who operate a machine "own" that machine. They are the first people that should be approached when addressing the operation, efficiency and processes of that machine and they should also be closely consulted in terms of any operational changes that might be proposed.

As well as effective internal communication, both from the top down and the bottom up, there must be external communication. The environmental policy of the organisation must be publicly available, and also systems in place both to allow and encourage communication with the local community and other stakeholders and for their views to be communicated back to the organisation. Corporate environmental reports (either as stand alone, or part of an annual report) are becoming more commonplace, and are discussed further under the Global Reporting Initiative.

## The Environmental Audit

An environmental audit is defined as:

*"a management tool comprising a systematic, periodic and objective evaluation of how well environmental organisation, management and equipment are performing with the aim of helping to safeguard the environment by; (i) facilitating management and control of environmental practices; and (ii) assessing compliance with company policies, which include meeting regulatory requirements"*

ICC[12]

The environmental audit determines progress against the objectives set – it is the checking part of the continuous improvement loop. This provides proof of effective implementation and

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performance improvements. Through the audit cycle environmental management becomes continuous and is an on-going process. Audits determine the capability of the EMS to achieve the organisation's environmental objectives and targets. The EMS must be audited on a regular basis to ensure that the system in working as intended.

It must be emphasised that the audit is checking for any failings within the system itself, in its operation or its ability to control the environmental impacts of the organisation. It is not performed to "catch" people out and this should be made clear to personnel in the planning stages of the audit.

**Management Review**


The revision of the objectives and continuous assessment of progress are as important as the audit itself and provide information on performance in a particular time frame. The audit provides the information which top management needs to review the EMS. The review is a check to ensure that the system is operating effectively. This top management review also addresses changes needed in the environmental policy, objectives and targets or in the EMS itself, in order to continue on the cycle of continual improvement.

**Certified Environmental Management Systems**

The International Standards Organisation presented, in 1996, the format for an independently certified Environmental Management System, ISO14001, which enables organisations to have their EMS audited by an external body, therefore allowing them to publicise the achievement of an independently certified EMS. This has become increasingly important in terms of international trade and supply chain requirements for improved environmental performance, with proof of sound environmental performance being required by many larger companies, both within the West Asia region and further afield.

At the end of 2001, 36,765 companies/organisations had been certified to ISO14001, only 245 (0.67%) of which were in West Asia (http://www.iso.ch). Those implementing ISO14001 have achieved cost savings, as well as minimised environmental impacts. Though the implementation of ISO14001, Petra Engineering in Jordan, who design, manufacture and service heating, ventilation and air conditioning equipment, have seen a variety of benefits, including direct costs savings, since the implementation of ISO14001. This includes increased employee involvement and morale, competitive advantage through demonstration of environmental commitment and increased knowledge and control of their operations. Some of the direct cost savings include savings of US$23,000 per annum through reduced power consumption and US$6,000 per annum from reduced waste materials from production departments. A case study of Petra Engineering's experiences in implementing an EMS is provided in the following section.

The standard provides organisations with the guidelines to form an effective EMS, while considering economic goals and the unique situation of each organisation. Environmental performance is gauged by measuring the results of an organisation's EMS, along with a careful evaluation of its environmental policy, objectives, and targets.

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## CASE STUDY OF EMS IMPLEMENTATION – PETRA ENGINEERING, JORDAN

### Background to Petra Engineering

The Petra Engineering Industries Company (Petra Engineering) is a private company with limited liability, established in 1987. The company's main activities are the design, manufacture and associated servicing of heating, ventilation and air conditioning equipment. It occupies a site of 22,000m$^2$ (covered area), for the current facility and a new extension of 11,000 m$^2$ (covered area) with a total area of 142,000m$^2$ and has a workforce of 1,000. Petra Engineering's workforce consists of highly skilled engineers and technicians supported by experienced management professionals.

The primary product lines of Petra Engineering include:

- Chillers
- Air Handlers
- Fan Coils
- Split Units
- Air conditioning packaged units

The company's vision is to become one of the leading HVAC manufacturers in the world by 2012. Within Jordan and the region, it is already making its mark, with a number of awards, including the King Abdullah II Award for Excellence. The company is certified to ISO9001:2000 and ISO14001:1996 and also has the CE Mark, allowing export to Europe, the EMC Certificate for electromagnetic compatibility and its ETL and UL Listed for product quality and safety. Furthermore, Petra's air handling unit coils have been formally accepted into the Forced Circulation Air-Cooling and Air-Heating Coils by ARI (Air-conditioning and Refrigeration Institute).

### Establishing the Environmental Management System

Petra Engineering recognises its responsibility towards the environment and its obligations to minimise the environmental impact of its activities, products and services. As such it has a published Environmental Policy (see Annex 2), which has as its key points continual improvement, pollution prevention, reducing natural resource consumption and reduced energy and water consumption. It also addresses control of air emissions, waste minimisation and labour safety. In order to guarantee effective execution of the EMS, Petra re-structured departments associated with environmental aspects. Accordingly, an environmental team with a team leader was assigned to handle all the environmental issues within Petra Engineering in a hierarchical manner. However, the main task for this team was to develop and implement the environmental management system in accordance with the requirements of the international standard ISO14001:1996 and to provide direction and support to all concerned departments

### Identifying Significant Environmental Aspects

In developing its environmental management system, Petra Engineering carried out a thorough review of its activities, identifying key environmental aspects. Areas of focus included:

- Design
- Manufacturing
- Painting
- Assembly
- Testing and charging
- Welding
- After sales services

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Some of the specific aspects identified by the company were:

- Refrigerants (R22, R407C and R134a)
- Diesel and electrical consumption
- Paper consumption
- Packing material consumption
- Foam consumption
- Transportation
- Used vehicle oil (garage)
- Diesel area inspection
- Sewage tanks
- Solid waste management and waste containers
- Work injuries and sick leave records

These aspects were reviewed by the company to identify the most significant, and specific objectives and targets for improvements were then developed to improve Petra Engineering's environmental performance. Petra Engineering identified these aspects using a significant impact flow chart for evaluating the significant impacts of the aspects based on significant impact criteria. This process involved all departmental managers along with the environmental team leader.

## Objectives and Targets

### *Waste Management*

Waste is viewed as one of the significant environmental aspects of operations. As well as the environmental impacts, Petra Engineering recognises waste as anything other than the minimum amount of equipment, materials, parts, space, and worker's time, which are absolutely essential to add value to the product. Waste has an impact on the company's efficiency and on its bottom line.

The company is therefore addressing control and reduction of waste produced through the implementation of the Waste Management Hierarchy; through waste minimisation, waste reduction, waste mitigation and waste control.

A number of areas of unnecessary waste production were identified during the review of operations, including:

- Overproduction
- Waiting
- Transportation
- Inefficient processing
- Inventory
- Unnecessary motion
- Product defects

From this review, a number of specific targets were developed to address waste within Petra Engineering, including:

✓ Reducing waste material from production departments by 5% by the end of 1999. This target was achieved, with an annual saving of US $5,600 to the company.

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✓ Reducing the waste generated from foam usage by 9% by the end of the year 2002, achieved through reducing the waste material generated from 10% in the year 2001 to be 1% in the year 2002. This objective has been fully achieved with new technology, standardisation and an enormous reduction of waste.

***Other targets:***

1. Reducing power consumption by 15% by the end of 1999. This was achieved with an annual saving of US $22,500.
2. Reducing water consumption by 10% by the end of 1999. This was achieved with an annual saving of US $1,700.
3. Reducing the environmental impact and pollution of diesel area by June 1999. This has been achieved.
4. Prevention of land pollution and reducing the environmental impact in the vehicle services area (garage) by August 1999. This has been achieved.
5. Reduction in the use of CFC refrigerant R22 and increasing the use of HFC refrigerant usage (R134a and R407C) by 5% by the end of year 2000. This has been achieved.
6. Reduction in diesel consumption for transportation by 10% and for the paint section by 10% by the end of year 2000. This has been achieved with a saving in transportation of US $3,500 and in the paint section of US $5,600.
7. Reduction in work injuries resulting from work activities and a reduction in the number of leave days resulting from injuries by 10% by the end of year 2001. This objective has been achieved with a saving of US $2,600.

## Monitoring and Benchmarking

The ongoing monitoring of operations is a key part of the EMS. As such Petra Engineering has established a monitoring system for the activities it carries out. The performance measurement of the EMS uses a number of tools. It looks at business factors through the nature of activities and determines Key Performance Indicators (KPIs) from activities. Through the ongoing review of this monitoring by top management, new objectives and targets are set, programmes developed for implementation and monitoring strategies determined.

References used for benchmarking include:

- Units produced
- Sales
- Total number of employees
- Working hours
- Previous years figures

An example of the type of benchmarking activities carried out includes monitoring and benchmarking of the objective to reduce the electrical consumption of the testing department by 10% by the end of the year 2002.

The actual recorded energy consumption for 2001 was 9,000kW and for 2002 was 10,000kW. However, the benchmarking reference that needs to be used is the total number of units tested. In 2001 this figure was 100 units, in 2002 it was 135 units. Therefore:

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- In 2001, 100 units were tested consuming 9,000kW = 90kW per unit
- In 2002, 135 units were tested consuming 10,000kW = 74kW per unit

i.e. a decrease in consumption per unit, thereby achieving one target towards the objective of reducing energy/fuel consumption.

## Obstacles to Implementation

Two kinds of obstacles were identified during the implementation of the EMS in Petra Engineering, internal and external. Internally there was an issue of employee culture and initial cost (new investments in environmental protection caused by legal requirements). Externally, the revised management of waste identified some problems in terms of identifying appropriate safe waste disposal depositories and where materials for recycling should be sent.

## Training and Awareness Raising

The training requirements for all employees in Petra Engineering are identified in accordance with the following requirements:

- Identifying levels and functions in Petra Engineering that are related to the environmental impact as follows:
    - Environmental team
    - Departmental managers
    - Employees (general)
    - Employees (specific)
    - Security
    - Suppliers
    - Contractors
- Determining training needs to different levels and functions in Petra Engineering
- Providing environmental awareness to employees by giving them a copy of (Employee Guide for Environmental Protection)
- Providing competence training to employees performing activities associated with environmental impact using a specific training program with intensive courses

## Petra Engineering Benefits of EMS Implementation

- Direct cost saving (as identified in the examples of specific targets above)
- Improving efficiency/reducing operating cost
- Maintaining regulator compliance
- Increasing overall efficiency as well as employee involvement and morale
- Reducing environmental impact.

A number of benefits in terms of maintaining good public community relations, enhancing image and market share (positive community image), assurance to customers of Petra Engineering's commitment to environmental management, health and safety the conservation of materials and energy have also been recognised. Through the increased knowledge and control of operations, the company is able to keep ahead of present requirements and improve its environmental performance.

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**Simple Cost Benefit Analysis of EMS Implementation**

| Cost of implementation | Total Benefits |
|---|---|
| Implementation cost (Financial + Time) | Return of investment and savings (as identified in the objectives above) |
| Research and Development for utilising R407C & R134a | Competitive market advantage |
| Cost of training and environmental awareness | Reduced waste, work injuries and potential for environmental incidents |

**Specific Case Studies on EMS Initiated Activities**

### I. New Petrol Station

During the review of activities within Petra Engineering it was noted that one of the major costs of the company, and one of its major environmental impacts was in terms of transport, including the use of petrol to fuel trucks and buses. The existing situation used commercial petrol stations to provide fuel, involving specific journeys to the commercial petrol stations for re-fuelling. It was therefore decided to construct a petrol station at Petra Engineering to reduce journeys and reduce costs of fuel by purchasing direct from suppliers rather than through commercial petrol stations.

The first stage in the project planning was to identify the potential environmental aspects of the new petrol station. Those identified were:

- Emissions to air
- Releases to water
- Land contamination
- Waste management
- Resources
- Community issues

In order to evaluate the significance of these a number of exercises were carried out. These included the development of a significant impact flow chart and the use of grading methodology. The key points addressed in identifying the significance of the aspects were:

i. Legal and legislation requirements (significant)
ii. Magnitude of effect on environment

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iii. Interested parties concern
iv. International concern
v. Complaints
vi. Scarcity of resources

Significant aspects record

i. Section (responsibility)
ii. Aspect
iii. Impact
iv. Control

The project has taken a number of stages, at each of which environmental considerations have been given top priority.

Design and development stage

i. Cost benefit analysis
ii. Feasibility study

Construction stage

i. Identification of aspects
ii. Design and operation
iii. Legal requirements and legislations

Operation stage

i. Handling of diesel
ii. Filling
iii. Routing of journeys
iv. Station maintenance
v. Emergency conditions
vi. Fire
vii. Spoilage
viii. Compliance with legal requirements
ix. Liaison with Jordan Refinery

For the operation stage, specific work instructions have been developed for each of the items listed above. There is also an ongoing programme to monitor the environmental aspects of operations to assess the potential environmental impacts. Based on the results of this, objectives and targets for improvement will be developed.

### II. New Methodology for Surface Treatment of Steel Structures (chemical treatment)

The original technique carried out by Petra Engineering involved a chemicals process to treat the surface of steel structures produced by the company. The process involved the passage of the steel structure through a water tank with sprinklers, a caustic soda wash (1.5% caustic

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soda), softener water, acid wash, softener water and then through to a dryer room before transfer to the control room.

During the review of processes in Petra Engineering it was highlighted that there might be a more environmentally benign method of treating the steel structures, using less water and less harmful chemicals. A logical process was then followed to review this part of the process to develop an appropriate solution.

## Continual Improvement of EMS at Petra Engineering

Petra Engineering is aware of its liability concerning the continual improvement of its EMS. Petra Engineering has learned to meet its individual market requirements, which have exceeded 40 markets worldwide. As a result, Petra Engineering regularly looks at new methodologies to ensure the effective exploitation of its resources and to identify opportunities to reduce waste in the factory. It also seeks more environmentally friendly methods to execute its activities without affecting its performance. These environmental management measures have yielded significant cost cutting benefits and environmental savings for Petra Engineering and the community. Another significant outcome that has resulted from this program is a positive change in employee mentality.

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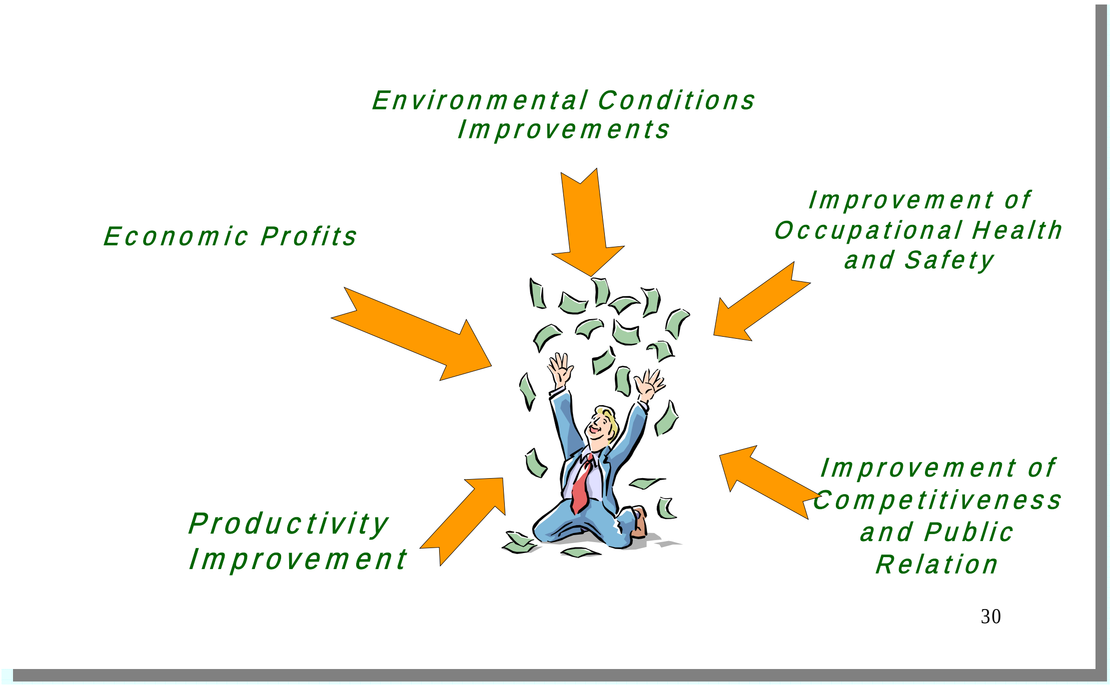
# CONCLUSIONS




The increasing use of voluntary initiatives by the industrial sector is extremely encouraging step, and this, alongside their promotion by regulatory bodies indicates a move away from purely command and control techniques in terms of industrial regulation towards a "shared responsibility" partnership, creating a more proactive approach to environmental management.

Cleaner Production techniques offer an efficient way to operate processes, produce products and to provide services, through the conservation of raw materials and energy, elimination of toxic raw materials, and reduction in quantity and toxicity of all emissions and wastes. In terms of products, it reduces negative impacts along the life cycle of a product; from raw materials extraction to its ultimate disposal and in services incorporates environmental concerns into design and delivery. Through Cleaner Production techniques, the costs of wastes, emissions and environmental and health impacts can be reduced, realising economic, environmental and social benefits, the three pillars of sustainable development.

Environmental Management Systems, as a tool to address the procedures used within an organisation to minimise impacts on the environment requires across the board commitment, but can bring about improvements in process performance and significantly improve a facility's bottom line through process optimisation, offering a wide range of potential benefits of implementation, including:

- The identification of environmental priorities and compliance issues;
- Structured approach to management of environmental issues and impacts;
- The strategic management of environmental impacts; and
- Demonstration of responsible environmental management.

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There are also potential financial benefits, derived from the structured approach to managing environmental impacts. These include:

- Avoidance of penalties and fines;
- Minimisation of clean-up costs and potential civil liabilities;
- Potential identification of cost-saving opportunities; and
- Positioning the organisation to efficiently manage the response to change.

In terms of management and public relations, voluntary initiatives can also bring about a number of benefits, including:

- "Peace of Mind" for managers;
- Avoidance of crisis management;
- Enhanced image; and
- Enhanced attractiveness as an employer and a supplier.

From an environmental perspective, there are also a number of gains:

- Reduction in consumption of natural resources and raw materials;
- Reduction in emissions;
- Reduction in waste sent for disposal; and
- Decreased risk of accidents, and if accidents do occur, appropriate response to minimise environmental impacts.

There are a wide range of other voluntary initiatives that should be considered by industry and regulatory agencies alike, namely Awareness and Preparedness for Emergencies at the Local Level (APELL), the Global Reporting Initiative (GRI) and the Global Compact. These are outlined in Annex 3 and are a focus of UNEP's industry activities in the West Asia region, alongside ongoing capacity building in Cleaner Production and Environmental Management Systems.

The challenge facing us now is to encourage industry to embrace these voluntary initiatives, to alter conventional design and manufacturing procedures in order to incorporate environmental considerations systematically and effectively. This requires changes not only in existing technologies and procedures, but also changes in the way people do things, often the more difficult task. In order to achieve that, clear environmental concerns and objectives must be introduced and communicated on all levels (industry, institutions, governments, consumers…etc.). Education campaigns fortified by laws and regulations, and perhaps political commitment can overcome such obstacles.

To this end, UNEP/ROWA has implemented the Programme to Improve Participation in Environmental Management Systems and Build Capacity for their Implementation (2002-2004) through which over 130 companies have received training in eight workshops throughout the region. To gain an insight to the level of implementation and the challenges faced by these companies, a questionnaire survey was circulated to participants in order to provide appropriate follow-up to the programme in the region. The summary report of the feedback is provided in Annex 4.

Small and medium sized industries have a particularly difficult choice making Cleaner Production investments for reasons that range from the cost of capital to the absence of appropriate funding mechanisms. Furthermore, Cleaner Production options are likely to be economically less attractive in countries with few and/or un-enforced environmental regulations, under-priced or free natural or labour resources, and little consumer interest in products that are produced and consumed in a more environmentally responsible manner. Although the pressure of consumer movements in developing countries has so far had limited influence on decisions related to the

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choice of production technology, such pressure is likely to increase considerably in the upcoming years. A more environmentally responsible approach to production processes is already taking place with some multinational companies extending such requirements to their supply chains in developing countries. With globalisation and the information revolution consumer demand for competitive products that are environmentally sound is also increasing rapidly. Cleaner production is after all a means to improve and manage industries image and reputation, promote efficiency and make the capital stock less environmentally damaging. Financial institutions have an interest in guiding their customers to positions that consider supply-side pressures, anticipated legislation, licenses and permits, and market trends.

Despite increased interest in this area, West Asian countries have yet to benefit significantly from the experience of the industrialised nations. This is mainly because of a lack of information on waste minimisation technologies, lack of financial resources, shortage in technical expertise, management resistance to employing what they view as disruptive changes, and lack of policy measures conducive to investment in such technologies. There is a need to influence environmental actions for new industrial activities in the region and identify likely problems and proper mitigation measures for pollution control, particularly in industries that emit hazardous wastes. The Environmental Impact Assessment regulations being instituted in most countries may encourage proper environmental planning for future industrial development.

Considering the rising costs of natural resources, the promulgation of environmental enforcement, new ways of thinking, patterns of future liability (e.g. Polluter Pays) and the increasingly competitive commercial market, it is indisputable that the application of voluntary initiatives in industry is a “win-win” situation, where production costs are reduced, energy is conserved, waste and emissions are reduced and relationships with stakeholders strengthened through increased transparency. It is this win-win scenario that UNEP is promoting both within the region and globally, working with all relevant stakeholders to achieve sustainable industrial development in terms of society, economy and the environment.

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## USEFUL WEBSITES

Cleaner Production: www.uneptie.org/pc/cp

Global Reporting Initiative: www.globalreporting.org

Global Compact: www.unglobalcompact.org

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## ANNEX 1

## SAMPLE QUESTIONNAIRE FOR AN INITIAL ENVIRONMENTAL REVIEW

### *Issue 1: Management Issues and Awareness*

By developing a comprehensive understanding of what and who makes the business function, this provides the "big picture" of the organisation and the context for the EMS. Some key questions:

1.1 Are any management procedures/systems in place with respect to environmental management?
1.2 Does the business have an environmental policy or are there any environmental components in other policies such as Health and Safety or Quality?
1.3 What training and staff involvement already takes place? What opportunities exist to build an environmental strand into this?
1.4 What is the senior management commitment to environmental management?
1.5 What is the culture of present management and how would environmental management fit with this culture?

### *Issue 2: Legislation and Other Requirements*

Complying with environmental law is a major obligation for any organisation. Legislation is continuously changing and the key to success for any organisation is to anticipate change and strive to modify operational practices to stay ahead of any changes to legal or other requirements.

2.1 What legislation applies to the business and how is it implemented?
2.2 What is the business response to meeting environmental legislation?
2.3 How is legislation monitored?
2.4 What relationships exist with regulators?
2.5 How are these relationships managed?
2.6 What other requirements apply, for example industry codes of practices or local requirements?

### *Issue 3: Marketplace*

3.1 What customer policies exist? How are these responded to?
3.2 Do suppliers and subcontractors know the business's supply standards / policy?
3.3 How do they respond? How are these relationships managed?
3.4 Is awareness raising/training part of the supplier/subcontractor relationship(s)?

### *Issue 4: Distribution and Transport*

A necessity of business life and a significant impact on the environment. Impacts might arise through the company car fleet, distribution vehicles or use of contract delivery services. Remember too, raw materials deliveries will also have transport implications.

4.1 What is the business mix of distribution and transport?
4.2 How much is spent on distribution and transport by? (a) Cars? (b) Lorries? (c) Contractors?
4.3 What management control measures are used?
4.4 How could distribution/transport costs be reduced?
4.5 Are vehicles regularly maintained and legal?
4.6 What driver training is provided?

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4.7 How is the site managed (eg fuel storage, vehicle loading and washing, etc)?

***Issue 5: Waste and Discharges***

Legislation increasingly requires that waste must be managed and companies may have a direct responsibility for it. Remember, waste=cost; once to buy it in as raw materials and once to dispose of it. Similar legislative requirements may apply to the discharges produced as a result of operations. These too must be managed properly.

5.1 Where and what are the wastes / discharges for each business activity? (a) To air? (b) To waste? (c) To land?
5.2 Who is responsible for them?
5.3 What is the cost to the business?
5.4 In terms of procedures, what … (a) is in place? (b) should be in place? (c) could be in place?
5.5 What are the relationships with regulators?
5.6 How could wastes / discharges be reduced?
5.7 Are there community issues with respect to: (a) noise? (b) nuisance? (c) vibration? (d) odour?

***Issue 6: Paper and Packaging***

This is an important issue. Paper use is a fact of business life. Even the so-called paperless office, promised just a few years ago, has failed to become a reality.

6.1 Where is most paper/packaging used?
6.2 What opportunities exist to reduce materials used?
6.3 What relationships with customers exist with respect to packaging?
6.4 Is packaging fit for reuse?
6.5 Are there plans for packaging minimisation?
6.6 Are there markets for 'waste' packaging materials?

***Issue 7: Site Management/Good Housekeeping***

An understanding of what activities take place on the site and how the site operates are important considerations. Site management offers many opportunities to minimise exposure to regulation and reduce environmental impacts.

7.1 How is the site used and what is kept on it?
7.2 Are storage methods and procedures appropriate for the materials being used?
7.3 How well is the site managed?
7.4 What records are kept? And how are these used?
7.5 Are staff trained in procedures and handling of materials?
7.6 Is the site/premises tidy and well maintained?
7.7 What relationships exist with the regulator with respect to materials stored and handled?
7.8 Are there any geographical/physical issues of relevance?

***Issue 8: Planning, Development and Land issues***

Knowing what regulations apply and having a good knowledge of land use issues is important information. The site may have been inherited from another business or there are plans to move to new premises.

8.1 What do you know about your site history? What has gone on before?
8.2 What planning regulations apply? Local, regional and national?

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8.3 Do you plan to develop your site? What will this mean in terms of land use and what are you required to tell the planning authorities?
8.4 Do you plan to move site? What will this mean in terms of land use and new regulations?

### *Issue 9: Product*

Think about your product. What is it you are actually producing? Good design can reduce environmental impacts from the start of a product's life to its final disposal.

9.1 What are your main products?
9.2 Where are the main environmental impacts?
9.3 Are products designed to minimise environmental impacts and reduce energy and waste?
9.4 Is environment considered in product design and development?
9.5 Are product design issues discussed with customers/suppliers?
9.6 What management procedures are in place to identify improvements in this area?

### *Issue 10: Process*

The way you operate your processes will impact on the environment.

10.1 What are the main processes?
10.2 Where is the main environmental impact(s) – actual or potential? Past, present and future?
10.3 Are production processes operated to minimise environmental impacts and reduce energy and waste?
10.4 Are operators trained in best practices?
10.5 Is environment considered in process design and development?
10.6 Are design issues discussed with customers / suppliers?
10.7 What management procedures are in place to identify improvements in this area?

### *Issue 11: Raw materials*

The nature of your business will dictate what you buy in as material for the production process. A listing of raw materials item by item will give you an inventory to work from. You should be able to find out systematically the source of your raw materials and begin to judge the environmental impacts caused along the way. There might be reasonable alternatives that your business could use to reduce these impacts.

11.1 What raw materials are purchased and where do they come from?
11.2 Do suppliers have an environmental policy?
11.3 How efficiently are raw materials used in production processes?
11.4 What options exist to reduce environmental impacts?
11.5 What is the purchasing policy with respect to raw materials?
11.6 Are materials minimisation plans in place?
11.7 Are there options to reduce environmental impacts of raw materials?

### *Issue 12: Hazardous Materials*

A quick tour will reveal just what hazardous materials are used and how much. Although the health and safety issues associated with their use are probably already being dealt with, there will be environmental issues associated with them that will need to be managed in the EMS.

12.1 What hazardous materials do you use?
12.2 Where do you use them?
12.3 How much do you use?

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12.4 Are all staff who need to be trained actually trained?
12.5 Assuming you satisfy all relevant health and safety considerations, what are the environmental implications of the use of these substances?
12.6 Do you have any choice to reduce their use, for example by switching to safer alternatives?
12.7 Can the suppliers of these substances help here?

### *Issue 13: Water*

Water is a major service to the business and an often overlooked resource. You just turn on a tap and it's there!

13.1 How much water is used and what is the cost?
13.2 Where is it used?
13.3 How is it used?
13.4 How is it discharged and how much does this cost?
13.5 What regulatory consents and constraints are in place?
13.6 What could be changed to reduce water usage?
13.7 Could water be reused?

### *Issue 14: Energy and Fuels*

Organisation can usually cut 10% off the energy bill without capital expenditure, another 10% from investment which rapidly pays for itself and another 10% by investing in the longer term. Saving money and reducing pollution can go hand in hand. Remember, every $1 saved by efficiency measures is a bottom line saving.

14.1 Energy used and unit cost: (a) Electricity (b) Gas (c) Oil
14.2 What is it used for?
14.3 What are the demand variations?
14.4 What management controls are in place?
14.5 What relationships exist with energy suppliers/advice on energy conservation?
14.6 Does equipment purchasing and maintenance include energy issues?
14.7 What opportunities exist for energy saving? (a) minimisation (b) energy recovery (c) energy reuse (d) renewable energy sources

### *Issue 15: Stakeholders*

Several of these stakeholder needs are addressed by the questions above. This final issue area addresses the remaining key stakeholders so their needs can be considered as part of the initial environmental review.

15.1 What are the needs of the customers themselves? What do they expect and what might they expect in the future?
15.2 What are the demands and expectations of your banks and insurance companies?
15.3 People care about the environment. Have you identified all your stakeholders and their concerns? How are relationships with 'the stakeholders' managed?
15.4 What measures do you take to involve staff in the process on environmental management? What are their expectations in these areas and how will you deal with them?

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## ANNEX 2

## ENVIRONMENTAL POLICY OF PETRA ENGINEERING

Petra Engineering Industries Co.

**Petra's Policy Towards Quality, Environment, and Testing Lab, Accreditation**

Petra Engineering Industries Company is considered a premier designer and manufacturer of air-conditioning equipment in the region. Petra is certified to ISO 9001:2000-QMS, ISO 14001:1996-EMS, CE Mark, EMC - Directives, UL-1995, ETL, also Petra is formally accepted into the Forced Circulation Air Cooling and Air Heating Coils by ARI, and at the national level of excellence, Petra has been awarded the King Abdullah II Award for Excellence (Second Term 2002) for the Large Manufacturing Category. Petra recognizes its responsibility towards quality, environment, Testing Lab Accreditation (TLA) and its obligations to provide a consistent product and minimize its environmental impacts through activities, design, production and services of its products. Petra has the following objectives:

| | Quality | | Environmental |
|---|---|---|---|
| * | Produce A/C units with consistent quality to meet customer requirements | * | Reducing waste through design and production, and effective use of natural resources |
| * | Guarantee after sales service | * | Reducing energy and water consumption |
| * | Continual design improvement | * | Reducing and controlling environmental pollutants |
| * | Improving production processes | * | Reducing and controlling diesel and water consumption |
| * | Opening new markets and increasing sales | | Maintaining labour safely |

The company is committed to fulfil the requirements of the Jordanian accreditation system and the general requirements for the competence of testing and calibration laboratories ISO/IEC 17025:1999 and to comply with the following:

| | Quality | | Environmental |
|---|---|---|---|
| * | Legal and technical requirements related to A/C units | * | Legal and other related environmental issues in A/C units |
| * | Continual improvement in QMS | * | Continual improvement in EMS |

The company will achieve this policy through the following frameworks:

- Continual implementation of QMS, EMS and TLA according to ISO 9001, ISO 14001 and ISO 17025.
- Establishing QMS and EMS programs to achieve objectives.
- Provide employees with awareness and training in QMS, EMS and TLA.
- Carry out internal QMS, EMS and TLA audits on regular basis.
- Conduct reviews of QMS, EMS and TLA by top management on regular basis to maintain continuity and effectiveness of the systems.

Top management is responsible for establishing this policy which is publicly available. Additional responsibility for running the system is carried out by the quality/environmental manager along with the involvement of all Petra employees.

**Deputy Managing Director.**

January 2003

Rev.4 Authorization: Eng. Osama Abu-Baha' Date: 09/01/2003

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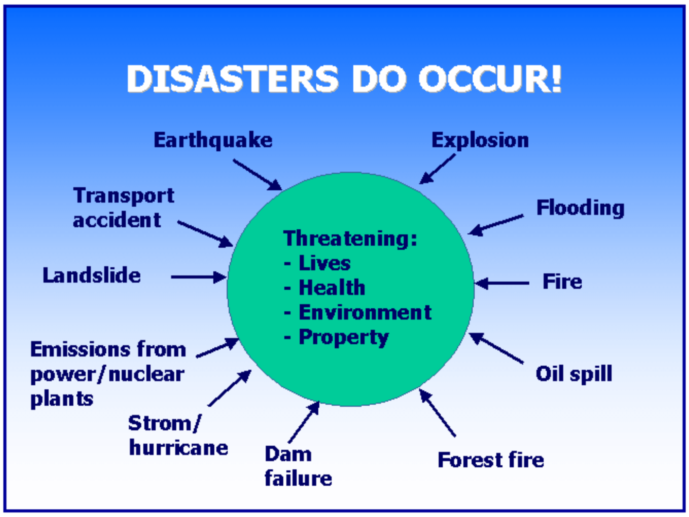
## ANNEX 3

## OTHER VOLUNTARY ENVIRONMENTAL INITIATIVES FOR INDUSTRY

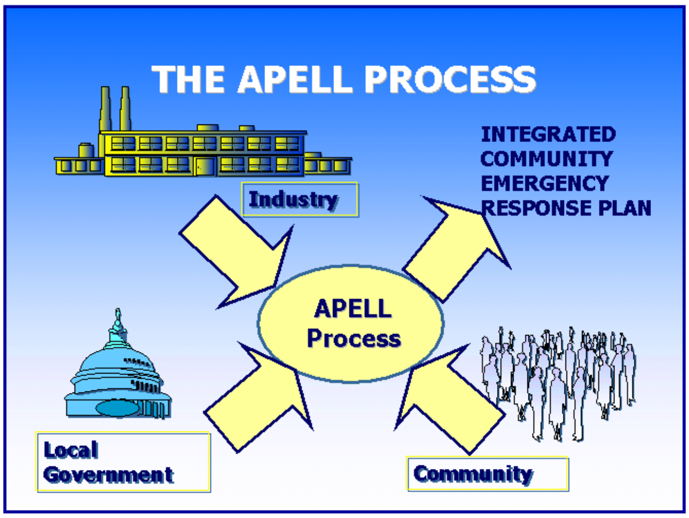
### 1. AWARENESS AND PREPAREDNESS FOR EMERGENCIES AT THE LOCAL LEVEL

The Awareness and Preparedness for Emergencies at the Local Level, or APELL programme, was developed by UNEP to improve preparedness and response to environmental emergencies. It is based on an in-depth analysis of major past disasters including earthquakes, explosions, landslides, transport accidents, oil spills and dam failure. The process has reviewed these historic events, taking account of what happened and trying to formalise a mechanism to minimise the negative impacts of future accidents and emergencies. One of the things it highlighted is peoples' observations to disasters, which included statements such:

> *"The negative impact is unacceptably high and could have been minimised if only…."*
>
> *"Hardly anybody expected that such an incident could even occur"*




APELL is based around intensive dialogue between relevant stakeholders, including industry, local government, civil defence and emergency services, the media and the local community. It emphasises cooperation between these stakeholders and the formation of a coordinating group to represent all their interests, focussing on raising awareness, preparation and actions to take in case of emergencies.




As such, the process consists of ten (10) steps:

1. Identify the emergency response participants and establish their roles, resources and concerns
2. Evaluate the hazards and risks that may result in emergency situations in the community
3. Have participants review their own emergency response plans for adequacy relative to a coordinated response
4. Identify the required

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response tasks not covered by existing plans

5. Match these tasks to the resources available from the identified participants
6. Make the changes necessary to improve existing plans, integrate them into an overall community plan and gain agreement
7. Commit an integrated community plan to writing and get approval from the local government
8. Educate participating groups about the integrated plan and ensure that all responders are trained
9. Establish procedures for periodic testing and updating of the plan
10. Educate the general community about the integrated emergency response plan.

UNEP has, through its Division of Technology, Industry and Economics (UNEP-DTIE) in Paris, promoted APELL worldwide, including a number of capacity building workshops within the West Asia region. A number of sectoral APELL procedures have been developed, including mining, ports, storage and transport.

The APELL Handbooks and further information can be found on the Internet at:

www.uneptie.org/pc/apell

## 2. GLOBAL REPORTING INITIATIVE

Sustainability reporting is part of a broad landscape of initiatives directly or indirectly linked to higher standards of accountability, including charters, principles, codes of conduct, management systems and performance standards. The Global Reporting Initiative, GRI, has been developed by UNEP in partnership with the Coalition for Environmentally Responsible Economies (CERES). It was established in 1997 to be a long-term multi-stakeholder international undertaking whose mission is to develop and disseminate globally applicable sustainability reporting guidelines for voluntary use by organisations reporting on the economic, environmental and social dimensions of their activities, products and services. It seeks to elevate sustainability reporting to the same level of rigour, comparability, credibility and verifiability expected of financial reporting, while serving the information needs of a broad array of stakeholders.


Its key objective is to help organisations report information in a way that presents a clear picture of the human and ecological impacts of their business to facilitate informed decisions about investments, purchases and partnerships. It seeks to provide stakeholders with reliable information that is relevant to their needs and interests and that invites further stakeholder dialogue and enquiry.

The GRI works through the publication of a set of Guidelines, identifying the information for

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inclusion in a GRI-based report, and Technical Protocols. The Technical Protocols provide detailed measurement methods and procedures for reporting on the key indicators identified in the guidelines. The types of performance indicators addressed include economic indicators, environmental indicators and social indicators.

The reporting principles espoused by the GRI are:

- Transparency
- Inclusiveness (engagement of stakeholders)
- Auditability
- Completeness
- Relevance
- Sustainability Context (within the overall context of ecological, social and other issues)
- Accuracy
- Neutrality
- Comparability (with earlier reports and other organisations)
- Clarity
- Timeliness

As a tool it seeks to develop a globally comparable reporting mechanism within industry, building on the increasing commitment by organisations to publish reports on their environmental and sustainable development performance.

Further information on the Global Reporting Initiative can be found on the Internet at:

www.globalreporting.org

## 3. GLOBAL COMPACT

The Global Compact is a vision of the UN Secretary General, Kofi Annan, introduced in a speech to the World Economic Forum in 1999. The Compact aims to build synergy between the private sector and three United Nations organisations (UNEP), the International Labour Organisation (ILO) and the UN Office of the High Commissioner for Human Rights (UN 1999). For the first time, these offices address principles that embrace protection of human rights, sound labour laws and environmental responsibility in a single international agreement. The mission of the Global Compact is to contribute to more sustainable and inclusive global markets by embedding them in shared values and to foster a more beneficial relationship between business and societies.


It has two main goals:

1. Internalising the Compact and its principles to become part of business strategy
2. Facilitate cooperation and collective problem solving between different stakeholders

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The actors in the Global Compact include business, labour, civil society organisations and other institutions, including academia. It is a voluntary corporate initiative, embracing transparency, dialogue and accountability to identify good practices and to find practical solutions to a range of problems and challenges. The mechanisms include dialogue, learning, projects and local networks. It is based on 9 principles:

1. Support and respect the protection of international human rights within an organisation's sphere of influence.
2. Ensure their own corporations are not complicit in human rights abuses.
3. Uphold the freedom of association and the effective recognition of the right to collective bargaining.
4. Elimination of all forms of forced and compulsory labour.
5. Effective abolition of child labour.
6. Elimination of discrimination in respect of employment and occupation.
7. Support the precautionary approach to environmental challenges.
8. Undertake initiatives to promote greater environmental responsibility.
9. Encourage the development and diffusion of environmentally friendly technologies.

At its core, the Global Compact seeks to promote greater environmental responsibility within industry through the use of a number of tools including assessment and audit tools (environmental impacts assessment, risk assessment, life cycle assessment), management tools (EMS, eco-design) and reporting tools (corporate environment/ sustainability reporting, GRI).

Further information on the Global Compact can be found on the Internet at:

www.unglobalcompact.org

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# ANNEX 4

## SUMMARY OF FEEDBACK OF QUESTIONNAIRE SURVEY ON EMS IMPLEMENTATION

### Background

Subsequent to the delivery of eight (8) Training Workshops on Environmental Management Systems, a short questionnaire was sent out to all participants to obtain an insight into the status of Environmental Management System implementation in the West Asia region. The questionnaire (attached as Annex 1) was sent to a total of 150 individuals. From this number 34 responses were received.

### Findings

Of the 34 questionnaire replies received, 10 companies indicated that they are already certified to ISO14001, while 24 were not. Of those 24 companies, 22 are in the process of implementing an Environmental Management System, with 19 of these intending to seek external certification of the system in the next 12-18 months.

Of the companies currently implementing an EMS, a variety of stages had been reached, with the majority having implemented the initial planning phases of an Environmental Management System, while development of procedures, training and emergency response plans are still to be developed. Annex 2 provides a graphical representation of the implementation status of these 22 companies.

All companies were also asked to outline any areas where they required specific assistance in the further implementation of their EMS. The listing below provides a summary of their responses.

- Support in the motivation of employees, including the provision of eye-catching posters, slogans, information leaflets and development of an appropriate communication and training strategy. This includes the development of a two-way communication strategy and methods of convincing top management of the value of EMS implementation
- Assistance in identifying the areas of focus for the environmental review
- Assistance in the identification of environmental aspects and impacts (particularly how much detail to do into)
- Clarification in responsibilities in legislation implementation between municipalities, regional and national environment bodies and in some instances the translation of legislative requirements into English (in the GCC countries)
- Methods of disposal of hazardous wastes
- Design of on-site wastewater treatment plant
- Information on BATNEEC (Best Available Technology Not Entailing Excessive Cost) for wastewater treatment, incineration of chlorinated hydrocarbons, flares and boilers

The companies that have already implemented an Environmental Management System were requested to outline any improvements that they might have made to their system as a result of attending the Training Workshop. Many of these companies indicated that taking part in such activities is always valuable, allowing them to share experiences with others and continually improve their own systems. Specific changes that were identified by respondents were:

- Seeking a greater involvement of top management in their system
- Updating and improving their approach to environmental training

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- The use of a rewards scheme to encourage employee participation in the identification of environmental improvements (in this case energy efficiency initiatives)
- Revised procedures in certain situations to further minimise the risk of environmental pollution
- Revised waste handling procedures in line with regulatory requirements introduced at the Training Workshop
- Adoption of the 3R's (reuse, recover and recycle) for waste management

## Conclusions

The respondents to the survey have demonstrated a commitment in the region to improving environmental performance. They have also indicated that there are some areas in which additional support is required, in terms of technical solutions as well as capacity building and awareness raising.

From the figure provided below, it can be seen that the front-end preparatory work to adopt Environmental Management Systems is well underway in most companies currently implementing a system. However, it appears that the actual implementation phase is still lagging behind, particularly in terms of training and emergency response.

In general, the feedback received to the questionnaires indicates that:

- There are a number of companies within the region with certified Environmental Management Systems (EMS) (ISO14001) who are constantly looking to improve their system
- Of those companies with ISO14001 there is a definite willingness to share their experiences as part of their own learning curve, and also to ensure that their suppliers, and indeed customers, are also pursuing a sustainable development path and taking account of their environmental impacts
- There are an even greater number of companies in the region currently implementing an Environmental Management System and who will be seeking external certification
- There are some gaps in knowledge/areas that additional support is required, particularly in terms of technology support (assistance in terms of wastewater treatment being reported in a number of responses).

## The Way Forward

As identified above, much of the further support requested by the respondents' focuses on end-of-pipe treatment/management. From this it would appear that preventive approaches, embracing Cleaner Production techniques and Life Cycle Assessment, are still of secondary consideration within the region.

Within enterprises in the region, particularly small and medium-sized enterprises (SMEs), UNEP is keen to promote the preventive approaches, including an emphasis on good housekeeping (very often providing "quick fix" solutions with immediate, visible results). As such, UNEP will continue to work, with its partners (the environment ministries and industrial support organisations) to provide awareness raising and capacity building materials on these issues, particularly through the identification of case studies from within the region to further promote the techniques.

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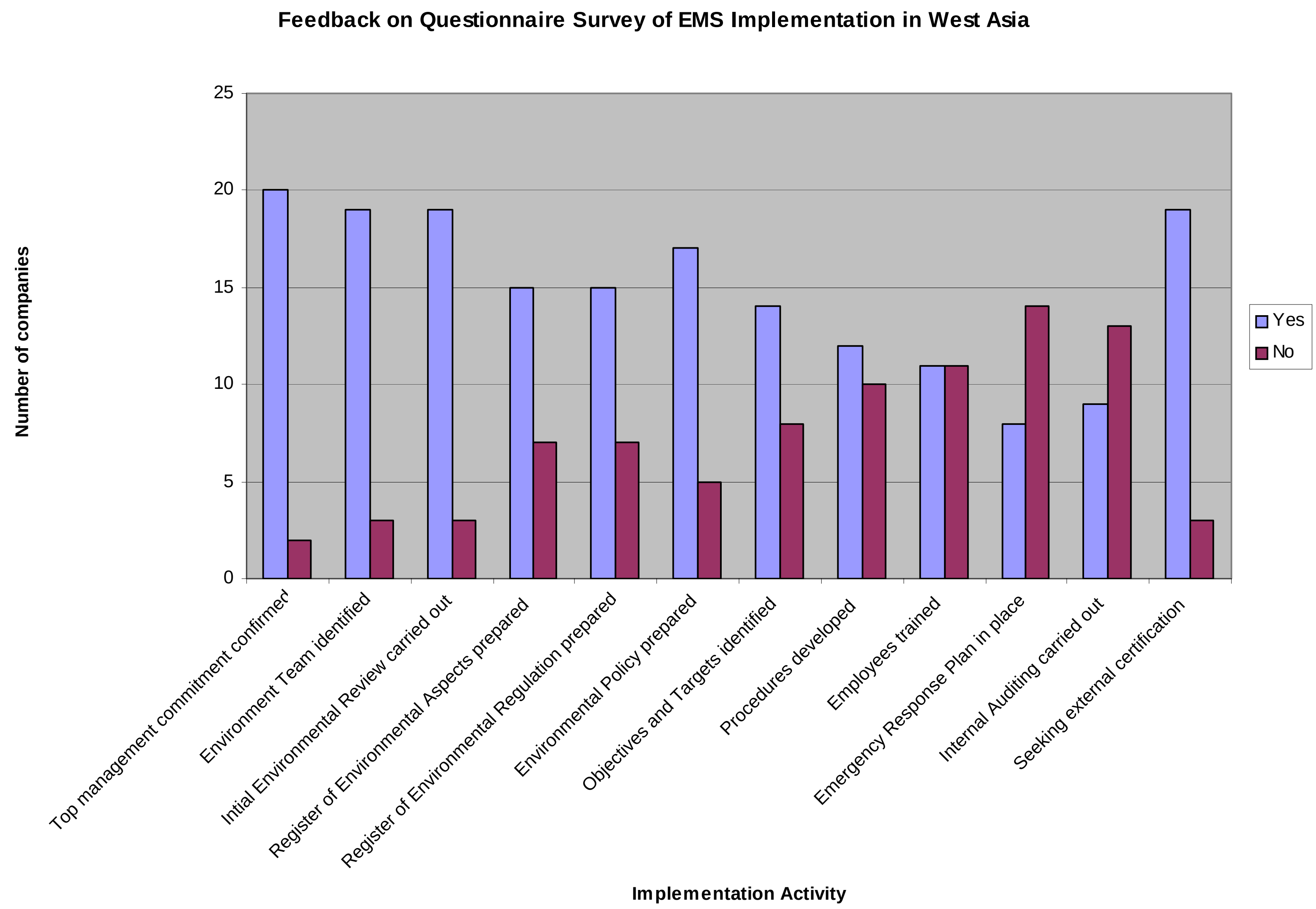

Feedback on Questionnaire Survey of EMS Implementation in West Asia
Number of companies
25
20
15
10
5
0
Top management commitment confirmed
Environment Team identified
Intial Environmental Review carried out
Register of Environmental Aspects prepared
Register of Environmental Regulation prepared
Environmental Policy prepared
Objectives and Targets identified
Procedures developed
Employees trained
Emergency Response Plan in place
Internal Auditing carried out
Seeking external certification
Implementation Activity
Yes
No