CLEANER PRODUCTION IN THE MEDITERRANEAN REGION

Ecomed

Agency for the Sustainable
Development of the Mediterranean

In cooperation with

UNEP

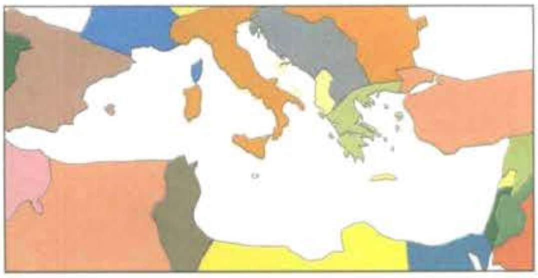
United Nations Environment Programme
Industry and Environment

and

IMPRESA ambiente

Cleaner Production Programme

Cleaner Production in the Mediterranean Region



Mediterranean Region

Albania	Jordan
Algeria	Lebanon
Cyprus	Libya
Egypt	Malta
former-Yugoslavia	Morocco
France	Syria
Greece	Spain
Israel	Tunisia
Italy	Turkey

The Editorial Board for this booklet was Jacqueline Aloisi de Larderel, Director, Industry and Environment, United Nations Environment Programme (Paris); Ossama A. El-Kholy, Adviser, Egyptian Environmental Affairs Agency (Cairo); Cristina Rapisarda Sassoon, Director, Impresa Ambiente (Milan); Gianni Squitieri, Director, ECOMED, Agency for the Sustainable Development of the Mediterranean (Rome).

This document was produced by ECOMED in cooperation with UNEP IE and Impresa Ambiente and with support of the City of Rome and of ACEA (Municipal Public Utility for Energy and Environment) on the occasion of the *International Mediterranean Local Agenda 21 Conference* - Rome, 22-24 November 1995.

Editorial coordination: Roberta Pignatelli
Translation: Ilaria Della Torre
Many thanks to Luigi Campanella, Saverio Civili, Garrette Clark, Marcel Crul, Mario Dubini, Robert Gould, Nicholas Peltier, and Beverley Thorpe

Graphic design and printing by
Stab. Tipolit. Ugo Quintily S.p.A. - Roma

CONTENTS

PREFACE

I am pleased that the City of Rome was able to contribute to the preparation of this report which is one of the latest efforts made by UNEP IE to disseminate the cleaner production concept to a wider public.

I am also gratified that this report was prepared jointly with ECOMED, the Agency for the Sustainable Development of the Mediterranean, promoted by the City of Rome. It is no coincidence that environmental protection and sustainable development rank high in the agenda priorities of the Rome local government. The case studies presented bear evidence that the implementation of cleaner production concepts and principles brings about not only economic but also environmental benefits to enterprises.

Francesco Rutelli
Mayor of the City of Rome

The United Nations Environment Programme Industry and Environement (UNEP IE), with the support of the United Kingdom, published the first volume of *Cleaner Production Worldwide* in 1993, providing 14 case studies from different industry sectors from all over the world. The document met with immediate success and since then UNEP IE has published two additional volumes, *Cleaner Production Worldwide: Volume Two* and *Cleaner Production in the Asia Pacific Economic Cooperation Region*.

Contributing to the worldwide effort to promote cleaner production, other organizations such as the National Environmental Protection Agency of China and BAPEDAL, the environmental agency of Indonesia, have also produced collections of case studies. This collection of case studies from the Mediterranean Region, prepared by ECOMED, is a further illustration of the growing implementation of the cleaner production concept.

The examples presented in this brochure demonstrate a broad range of cleaner production applications from different companies. They also illustrate different cleaner production programmes that are operating at local, regional and national levels, highlighting the new institutional arrangements that have been created to support the implementation of cleaner production.

UNEP welcomes all new partners to the Cleaner Production Network to help promote the cleaner production concept. Together, through this informal network, we can share successful experiences in cleaner production policies and technologies, and further contribute to sustainable development.

Jacqueline Aloisi de Larderel
Director
Industry and Environment
United Nations Environment Programme

INTRODUCTION

Victor Hugo once said that nothing is more powerful than an idea whose time has come. It is barely six years since United Nations Environment Programme, Industry and Environment (UNEP IE) in Paris formulated this new all-embracing concept of "cleaner production" and launched it in a Senior Level Expert Seminar held in Canterbury, U.K. Cleaner production is a logical progression from older and more restrictive concepts on "low and non-waste technology" or "pollution prevention".

Although the term has spread quickly worlwide and is currently adopted and used by many, I am not quite sure that its implications are fully appreciated by all those who use it. Cleaner production is not a one-time exercise - it is a continuous and sustained endeavour in pursuit of higher environmental goals. Cleaner production is not a bag of "technical fixes" - it is an on-going strategy.

At the technical level, it is a "cradle to grave" approach that extends upstream of production to investigate the types, qualities and quantities of material inputs and environmental impacts involved in their extraction and processing. Downstream of production, it examines utilisation and the ultimate fate of discarded products. Cleaner production does not address technological processes alone - it examines the design of products and delivery of services.

At the societal level, cleaner production questions the very need for a particular product in its current form. This means that it investigates consumption patterns and the lifestyles behind them. The issue of sustainable consumption patterns has been raised by the Commission on Sustainable Development (CSD) and a ministerial conference on the subject was held recently in Norway.

This is indeed a tall order that calls for sustained effort, not only at the conceptual level; but on the operational level through the proliferation of practical examples that demonstrate clearly the combined economic, social, as well as environmental, benefits of the cleaner production approach.

The present report is a very valuable boost for the pioneering efforts in Mediterranean countries to implement cleaner production in our part of the world. Let us look forward to more reports in which even more case studies of successful examples are explained as proof of the benefits of the adoption of cleaner production approaches as effective means of environmental protection throughout the Mediterranean Region.

O.A. El-Kholy
Egyptian Environmental Affairs Agency
Core Group member, UNEP IE
Cleaner Production Programme

The Need for Cleaner Production (*)

What is cleaner production?

Over the past 30 years, the industrialized nations have responded to pollution and environmental degradation in four characteristic ways:

- first, by ignoring the problem;
- secondly, by diluting or dispersing the pollution, so that its effects are less harmful or apparent;
- thirdly, by trying to control the pollution and the wastes (the so-called 'end-of-pipe' or pollution control approach); and
- fourthly, and most recently, by cleaner production through the prevention of pollution and waste generation at the source of production.

The sequence of 'ignore, dilute, control and prevent' is one which has culminated in an activity which combines maximum positive effects on the environment with substantial economic savings for industry and society.

Achieving this is, essentially, the goal of cleaner production—defined as the continuous use of industrial processes and products to prevent the pollution of air, water and land, reduce wastes at source, and minimize risks to the human population and the environment. The essential elements of the cleaner production definition are summarized in the flow chart below.

Cleaner production can be applied to the processes used in any industry and to industrial products themselves. For production processes, cleaner production results from one or a combination of the following measures: conserving raw materials, water and energy, eliminating toxic and dangerous raw materials, and reducing the quantity and toxicity of all emissions and wastes at source during the production process. For products, cleaner production aims to reduce the environmental, health and safety impacts of products over their entire life cycles, from raw material extraction, through manufacturing and use, to the 'ultimate' disposal of the product.

The key difference between pollution control and cleaner production is one of timing. Pollution control was an after-the-event, 'react and treat' approach; cleaner production is a forward-looking, 'anticipate and prevent' philosophy. Prevention, as is well known, is always better than cure.

This is not to claim that end-of-pipe technologies will never be required. The new approach is to tackle problems using a cleaner production philosophy, which will lead to a better selection and planning of technology. This will lead to a reduced need for end-of-pipe technologies and may in some cases even eliminate the need for them altogether.

Cleaner production can be achieved in a number of different ways, of which the three most important are:

- changing attitudes;
- applying know-how; and
- improving technology.

It is important to stress that cleaner production is not simply a question of changing technology: changing attitudes means finding a new approach to the relationship between industry and the environment, and simply re-thinking an industrial process or a product in terms of cleaner production may produce the required results without importing new technology.

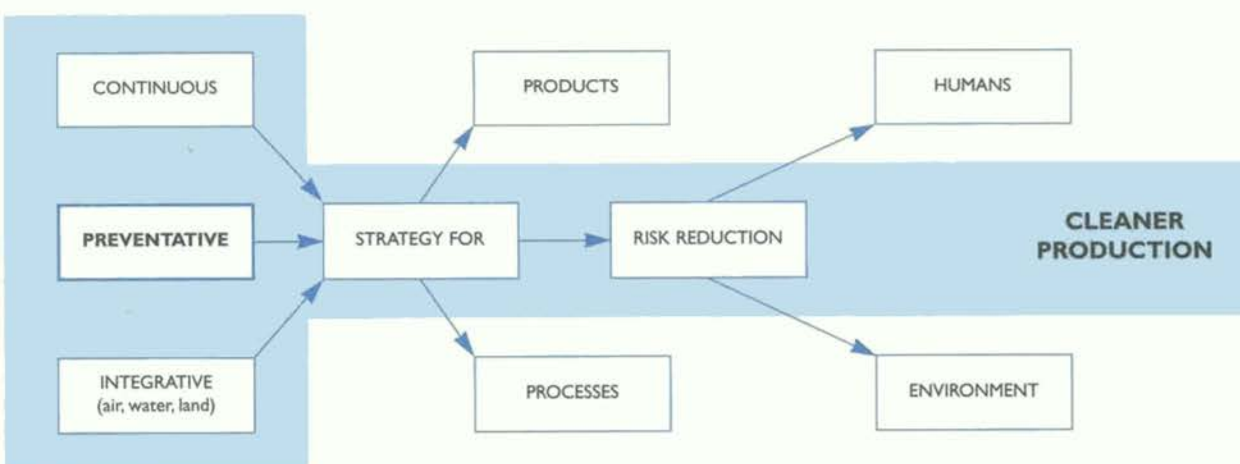
Applying know-how means improving efficiency, adopting better management techniques, changing housekeeping practices, and revising policies, procedures and institutions as necessary.

There are several ways of improving technology. For example:

- change process or manufacturing technology;
- change input materials;
- change the final product; and
- reuse materials on-site, preferably within the process (off-site recycling is not part of cleaner production, though it may bring substantial environmental benefits).

Examples of these processes are given in the box on page 5.

Essential elements of a cleaner production strategy



Examples of cleaner production techniques

IMPROVE HOUSEKEEPING

Reduce raw material and product loss due to leaks, spills, drag-out, and off-specification solution.

Improve monitoring of operations and maintenance of all facets of the production process.

Schedule production to reduce equipment cleaning—for example, formulate light before dark paints so that vats do not have to be cleaned out between batches.

Train employees in cleaner production.

Improve management of inventory of raw materials and products.

CHANGE PROCESS TECHNOLOGY

Filtration and washing: Use countercurrent washing and recycle used solvent.

Parts cleaning: Use mechanical cleaning devices; improve drainig before and after cleaning; use plastic-bead blasting.

Surface coating: use electrostatic spray-coating system; use powder coating systems; use airless air-assistend spray guns.

CHANGE PRODUCT

Batteries: replace heavy metals (such as cadmium, lead, mercury and nikel) in batteries with less toxic materials.

Spray cans: replace volatile chemicals with water-soluble formulation as aerosol.

Refrigerators: replace CFCs with ammonia or other environmentally-safe materials.

CHANGE INPUT MATERIAL

Printing: substitute water-based ink for chemical solvent-based ink.

Textiles: reduce phosphours in wastewater by reducing use of phosphate-containing chemicals; use ultraviolet light instead of biocides in cooling tower.

Electronic components: replace water-based film-developing system with a dry system.

REUSE MATERIALS ON-SITE

Printing: use a vapour-recovery system to recover organic solvents.

Textiles: use ultrafiltration system to recover dye-stuffs from waste water.

Metal rules: recover nichel-plating solution using an ion-exchange unit.

Individuals and industries may be richly rewarded for taking preventive environmental action in the form of cleaner production. Experience in both developed and developing countries shows that this new approach not only produces a cleaner environment but also results in substantial savings for industry and society.

Cleaner production can be—and has already been—applied to raw material extraction, manufacturing, agriculture, fisheries, transportation, tourism, hospitals, energy, information systems (for example in process control) and the organization of work.

Cleaner production and sustainable development

Both developed and developing countries have often introduced technologies without realizing how much it was going to cost to control pollution from them. They have then argued that a trade-off has to be made between economic growth and the environment, and that some level of pollution must be accepted if reasonable rates of economic growth are to be achieved.This argument is no longer valid, and the UN Conference on Environment and Development (UNCED), held in Rio de Janeiro in June 1992, established new goals for the world community which involve environmentally-benign forms of development.

Cleaner production can contribute to the sustainable forms of economic development endorsed in UNCED's Agenda 21 (see chapters 20, 30 and 34). Cleaner production can minimize or eliminate the need to make trade-offs between economic growth and environment, between worker safety and productivity, and between consumer safety and competition in international markets. Optimizing several goals at the same time in this way leads to 'win-win' situations in which everyone gains. Cleaner production is such a 'win-win' strategy: it protects the environment, the consumer and the worker while improving industrial efficiency, profitability and competitiveness.

Cleaner production is also now especially attractive to developing countries and those undergoing economic transition because it provides industries in these countries, for the first time, with an opportunity to 'leap frog' over older, more established industries which are still saddled with costly pollution control technologies. Thus countries that start to adopt cleaner production now will be able to take full advantage of a rare window of opportunity which for once favours developments in poorer countries over those in the industrialized nations.

Why invest in cleaner production?

Investing in cleaner production, to prevent pollution and to improve natural resource use, is cheaper than continuing to rely on increasingly expensive end-of-pipe or pollution control technologies. The initial investment for pollution control and cleaner production processes may be similar. But over time pollution control costs continue to mount while cleaner production investments level off. By 1989, the OECD countries alone were spending US$22 billion a year to control the spread of the 310 million tonnes of hazardous wastes generated every year (OECD, *Thchnology and Environment Programme of Work, 1991-92*, Paris, 1991).

As has been said, cleaner production is quite distinct from the traditional pollution control strategy which relies on 'end-of-pipe' technologies. Cleaner production is inherently more preventive, whereas pollution control strategies accept waste, emissions and effluents as a 'given' and try to find ways to handle them or minimize their effects. Pollution control technology, once purchased, is often not properly maintained and its future environmental benefits can therefore be illusory. This is the inevitable result of a technical fix that seeks to treat the symptoms of a problem rather than address its causes. When cleaner production and pollution control options that solve the same environmental problems are properly evaluated against one another, the cleaner production options will usually be less costly to implement, operate and maintain over the long term (or even the short term) because of reduced costs for raw material, energy, pollution control, waste treatment and clean-up, and regulatory compliance. Payback times can vary between a few months to a few years. In addition, the environmental benefits and performance are greater.

This latter benefit can be translated into market opportunities for 'greener' products. Systems and products for which good environmental performance has been factored in at the 'design' stage will be cheaper to operate and maintain, as well as less polluting and therefore less harmful to human health. Cleaner production therefore provides industries with a new range of benefits (see box below).
It also introduces them to new tools such as Life Cycle Assessment and Eco-labelling.

Arguments for investing in cleaner production

Cleaner production

- is the most fundamental approach;
- leads to product and process improvements;
- saves on raw materials and energy, and thus reduces production costs;
- increases competitiveness through the use of new and improved technologies;
- reduces the need for more restrictions and prohibitions;
- reduces risks from on-and off-site treatment, storage and disposal of toxic wastes;
- improves the health and safety of employees;
- improves a company's public image; and
- reduces the cost of increasingly expensive end-of-pipe solutions.

Cleaner production can be practised now

It is often claimed that cleaner production technologies do not yet exist and that, where they do exist, they are already patented and can be obtained only through expensive licences. Both statements are untrue.

Cleaner production approaches are widely and readily available, and techniques do exist for identifying and evaluating needed technologies. While it is true that cleaner production technologies do not yet exist for all industrial processes and products, it is estimated that 70 per cent of all current wastes and emissions from industrial processes can be prevented at source by the use of technically sound and economically profitable procedures (L.W. Baas, M. van der Belt, D. Huisingh and F. Neumann, 'Cleaner Production: what some governments are doing and what all governments can do to promote sustainability', *European Water Pollution Control, vol 2, n. 1*, 1992).

Secondly, cleaner production depends only partly on new or alternative technologies. It can also be achieved through improved management techniques, different forms of work organization and many other 'software' approaches to industrial products and processes. Cleaner production is as much about attitudes, approaches and management as it is about technology. This is why it is called cleaner production and not cleaner technology.

Fulfilling international obligations

Finally, while cleaner production is a means of improving industrial performance and protecting the environment, it is equally an effective device for complying with the complex array of rules and regulations designed to protect the environment. This is obviously true, for example, for local government regulations that specify levels of permitted discharges into the air and water. But it is also true of the new and more demanding requirements for international adherence to conventions on ozone-depleting substances, the discharge of toxic materials, climate change and biodiversity. Industries and nations embracing cleaner production will find that in so doing they will more easily fulfil many of their international obligations to the environment.

(*) This section was adapted from *Government Strategies and Policies for Cleaner Production*, UNEP, 1994.

Cleaner Production in the Mediterranean Area

Introduction

Cleaner production development is of vital importance to safeguard the land and the sea of the Mediterranean region. The recent ECOMED *Report on the State of the Mediterranean Environment* states that industrial pollution, in combination with random urbanization and uncontrolled energy consumption, is one of the major causes of *mare nostrum* degradation.

The text of the Mediterranean Action Plan (MAP), drafted by the United Nations Environment Programme (UNEP) and adopted last June in Barcelona, argues that:"... Industrial development exacerbates a number of existing major problems relating to air and water pollution and degradation of quality of life. In order to respond to national needs and provide access to Mediterranean and international markets so that sustainable development may be achieved, action should be taken:

- to encourage and facilitate the use of appropriate industrial procedures and clean technologies;
- to facilitate the transfer, adaptation and control of technology among Mediterranean countries;
- to consolidate and accelerate the introduction of programmes for the control and reduction of industrial pollution; and
- to strengthen and expand programmes for the reduction and management of industrial waste".

In June 1995 the Ninth Meeting of the Contracting Parties to the Barcelona Convention approved, and the Conference of Plenipotentiaries adopted, the following activities in the area of Industry and Energy for 1996-2005, taking into account Agenda MED 21:

- to identify the best available, environmentally sound techniques and practices, in the areas of energy, paper, tanning, cement production, metallurgy, agro-industries and inorganic chemical production;
- to promote the development and implementation of programmes for the transfer of appropriate technologies, especially clean and safe technologies;
- to develop and implement programmes to reduce and monitor pollution emissions; and
- to promote and facilitate the use of new and renewable sources of energy in the domestic, public and private sectors".

Following these recommendations, the signatories of the Barcelona Convention reached an agreement on a progressive middle-term ban on toxic chemical compounds in the air and water (including coastal areas).

State of the art

On the whole, even though few of the Mediterranean countries have a consistent regulatory framework to promote cleaner production, activities are increasing. Of particular interest are the non-European Mediterranean countries, where combining development and environmental protection is problematic.

Tunisia, for example, is active in promoting cleaner production. The National Environmental Pollution Prevention Programme (EP3), supported by the United States Agency for International Development (US AID), pursues two main objectives: promoting the cleaner production concept and its applications to industries in order to prevent pollution and improve efficiency, and to develop national cleaner production capacity and an infrastructure via the establishment of a Pollution Prevention Programme. The Programme provides technical, analytical and information services to facilitate the adoption of pollution prevention approaches. In particular, the Programme focuses on providing technical assistance to specific industry sectors, identifying and implementing low- and no-cost solutions. Some 50% of current pollution could be eliminated through simple good housekeeping practices and process modifications. The Programme also provides training on general and specific issues on various topics of industrial and urban environmental management.

As of August 1995, EP3 Tunisia had conducted pollution prevention diagnostic assessments at 11 industrial enterprises and 2 hotels. These audits identified over 200 pollution prevention measures that will cost 1 million DT, - but - will cut operation and management costs by 4,5 million DT each year. The recommended measures will annually conserve at least 230,000 m3 of water, 600,000 kwh of electricity, 500,000 m3 of gas and 120,000 liters of fuel oil.

Similar activities are developing also in Egypt. The Egyptian Pollution Prevention clearinghouse is an information centre established by the Egyptian Energy Conservation and Environmental Protection Project (with additional support from US AID), to provide industrial enterprises with information on concepts, techniques, technologies, programmes and case studies on pollution prevention. Last year Egypt launched its National Industrial Pollution Prevention Programme. Several European donors are actively involved in supporting the application of cleaner production strategies. The World Bank is negotiating the establishment of a Pollution Abatement Fund.

Interesting activities are also underway in other areas of the Mediterranean basin, as shown by the case studies presented in this report.

In some countries Cleaner Production Centres have been established to support information dissemination and demonstration project activities and to develop national capacity to implement cleaner production.

This is the case of the Cleaner

Technology Centre in Malta. Established by the government in 1993, it is based at the national university and is aimed at leveraging limited financial and human resources by promoting collective initiatives amongst government, industry and academia.

In Greece, a Cleaner Production Centre was recently established. Its activities are focused on small- and medium-sized enterprises.

A Centre for Cleaner Production Initiatives in Barcelona has been in operation since 1993. It is a tool that enables the Catalan autonomous regional government to encourage local industries to adopt waste minimisation practices. The Catalan activity is not an isolated case in Spain, where environmental management is addressed at the regional level. The 17 autonomous communities are called upon to contribute to basic domestic central legislation. This structure allows different levels of environmental management development. Some regions like Catalonia and the Basque country have already set up environmental institutions.

In Italy, despite the lack of formal legal and financial incentives, enterprises have begun to reassess their approaches to environmental management and, indeed, their production processes over the last 5 years. Change, however, often occurs after traditional, end-of-pipe solutions have been tried. These cleaner production initiatives have received support and encouragement through voluntary agreements sponsored by industrial associations. The national Association of Chemical Industries (FEDERCHIMICA) is a case in point.

In the Italian region of Lombardy, the Source Reduction in Waste Production Programme was undertaken in 1993-94. It was the first comprehensive programme launched in Italy. Implemented by Lombardia Risorse SpA with the support of the Regional Council, it focused on the introduction of cleaner production approaches in small- and medium-sized enterprises. Rome promoted another activity through the establishment of ECOMED, the Agency for the Sustainable Development of the Mediterranean. Amongst its priorities is the promotion of cleaner production.

Many of these centres have taken part in the European Union (EU) PREPARE (Preventive Environmental Protection AppRoach in Europe) initiative. It is a network of EU cleaner production activities founded in 1990, aimed at identifyng research and development needs and at facilitating cleaner production information exchange amongst participating organizations.

Cleaner production approaches adopted in the Mediterranean EU member states have been documented in an EU Report (Birgitte Nielsen, et al., *Waste Management: Clean Technologies Up Date on the Situation in Member States*, June 1994). In general the report found that:
- although the concepts and principles of cleaner production have been discussed for more than a decade in Europe, the principles in compulsory legislation appear in only a few countries and actual enforcement is limited; and
- the promotion of cleaner technology seems to be carried out primarily through voluntary initiatives such as grant schemes, subsidies and awareness raising initiatives, rather than through economic instruments such as "eco" taxes and permit schemes.

In short, this means that companies who do not actively incorporate environmental concerns into decision-making may not have been exposed to the potential benefits to be realized through implementing cleaner production.

The table on page 9 gives an overview of the large differences that exist in the use of policy instruments between European Mediterranean countries and other Western countries (the table does not imply anything about the efficiency of the policy instrument in place in each country - sources: Commission of the European Union, DG XI, *Waste Management: Clean Technologies - Update on Situations in Member States*, Bruxelles, June 1994, draft; and J. Hirschhorn and K. Oldenburg, *Prosperity without Pollution*, Nostrand and Reinhold, NewYork, 1991).

The EU Research & Development programmes on cleaner production

EU R&D programmes include:

- The AVICENNE initiative, that is the EU scientific and technical cooperation with Mediterranean third countries. These countries are Algeria, Cyprus, Egypt, the Lebanon, Malta, Morocco, Israel, Jordan, Palestine, Lybia, Tunisia and Turkey. 15 new proposals worth ECU 5.3 million for research were chosen in 1994. The research sectors chosen were the treatment of waste water, the use of renewable energy, etc.

- The SUBPRINT Programme. The EU will give 40% grants to groups that wish to do a solvent substitution programme.

- The BRITE/EURAM Programme on Industrial and Materials Technology R&D, that is the biggest single programme of interest for cleaner production R&D within the Fourth Framework Programme. In it, development of specific new, often cleaner, technologies or product development can be pursued. Actually, all BRITE projects are screened on their environmental impact, and no negative impact is allowed. Also, there is a separate lin in BRITE for recycling technologies. A large part of the actual projects is concerned with cleaner production at this moment. However, distance to market of BRITE projects is approximately 5-7 years, so implementation will only start on the middle-long term.
Next to this, R&D into environmental technologies, among which cleaner technologies, can be financed by the Environment and Climate programme. Also, a separate section on "Human dimensions of environmental change" includes several interesting projects.

- LIFE, that is the financial instrument of the Fifth Action Programme of DG XI.

Differences in the use of policy instruments between European Mediterranean countries and other Western countries

	NL	DK	SP	UK	FR	BE	GE	PO	IT	GR	EI	LU	USA
Legislation													
Approval scheme including cleaner technology	●	●	○	●	○	○	○	○	○	○	▲	●	●
Voluntary agreements	●	●	○	○	○	○	●	○	○	○	○	▲	●
Financial instruments													
Tax, duties and fees	●	●	○	○	●	▲	●	○	○	○	○	○	●
Grants and subsidies	●	●	●	●	●	●	●	●	▲	●	○	●	●
Information and education													
Demonstration projects, processes	●	●	●	●	▲	●	●	○	○	○	○	○	●
Demonstration projects, products	●	●	○	○	○	●	●	○	○	○	○	○	○
Consultant support	●	●	●	●	●	●	○	○	●	○	●	○	●
Centres of expertise	●	○	○	●	○	●	●	○	●	○	●	○	●
Newletters	●	●	○	●	○	●	●	○	●	○	●	○	●
General manuals	●	●	▲	●	●	●	○	▲	○	○	○	○	●
Industry-specific manuals	●	●	○	▲	○	▲	○	○	○	○	○	○	●
Databases	●	●	●	○	○	●	○	○	○	○	○	○	●
Videos	●	●	○	●	○	○	○	○	○	○	○	○	●
Conferences and seminars	●	●	○	●	●	●	○	▲	○	○	●	○	●
R&D programmes	●	●	○	●	●	●	●	○	●	●	●	○	●

● : yes ▲ : under preparation ○ : no activities or no information

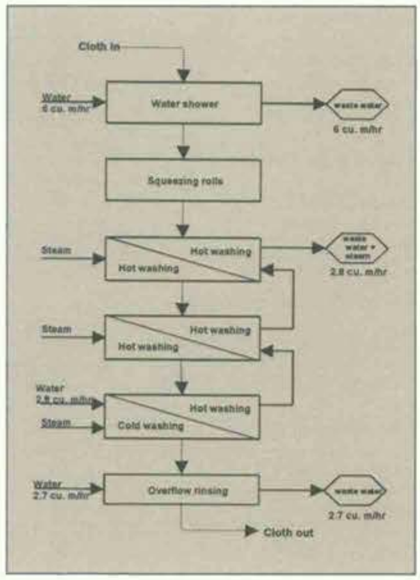
Each project has its own objectives and priorities. There is no specific focus on cleaner production although many projects focus on waste minimization. The LIFE programme is reconstructed now and will focus more on sectorial approaches and, hopefully, more on cleaner production.

- In the field of programmes specific on energy issues, several are also focusing on cleaner production. For instance, the JOULE/THERMIE programme finances projects on energy strategies, rational use of energy in industry and buildings, renewable energies, and clean technologies for fossil fuels.
Next to the specific EU R&D programmes, the EUREKA framework allows for financing of bottom-up industrial technology projects in most European countries (also outside EU), usually precompetitive but with a shorter time-to-market then BRITE-EURAM. The environmental portfolio, including cleaner production, of EUREKA is impressive.

- MEDCITIES. The EU reiterated its conviction that the stability and prosperity of Mediterranean non-member countries are vital elements for the Community itself and that ".. the relations between the two must take a leap forward". In 1993 the Medcities network under the Mediterranean Environmental Technical Assistance Programme (METAP) carried out 5 environmental audits in 5 cities located in Morocco, Algeria, Tunisia, the Lebanon and Cyprus. The aim was to involve local communities, recognize the main problems and work towards solutions. All problems identified (lack of institutional bases for sustainable development, regulations on environmental impact statements seldom enforced, uncontrolled urban and tourist development, water shortage, improper waste management) need solutions. It is crucial that cleaner production methodology be incorporated as action plans are developed with international loans. That said, the main success of this programme was the commitment to keep working towards environmental solutions in a participatory manner (see the Mediterranean Cities Conference, Gabinet de Relacions Exteriors, Barcelona, March 1995).

- Lastly, during the Euro-Mediterranean Conference that will be held in Barcelona in November 1995, the new EU programme will be initiated. Under this programme some 5.500 Mio ECU will be invested in Southern Mediterranean countries from 1995-99.

A Success Story from a Textile Company



Background

BTM, Bishara Textiles Manufacturing Co., is located in the industrial park Tenth of Ramadan City, a suburb of Cairo, Egypt. The company produces fashion garments for the men's and women's wear market. These garments are made from fabrics of wool, cotton, cotton/polyester, wool/acrylic and rayon. Seventy-five percent of production is for the domestic market, and approximately 25% for export.

The main unit operations are described below.

Fabric Preparation:

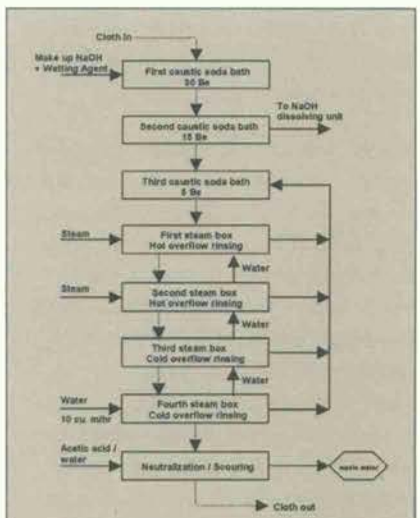
- Plating: The greige cloth is inspected and sewn together to be ready for the next operation.
- Bleaching: The cloth travels through the preparation line twice. In the first process it is desized, washed and dried. In the second run it is bleached, washed and dried.
- Mercerizing: Only the cotton fabrics are mercerized. The cloth is immersed in 20 to 30% caustic solution for a short period of time and then washed clean.

Printing and Dyeing:

- Flat bed printing
- Roller bed printing
- Jet dyeing
- Jigger dyeing
- Pad batch dyeing

Treatment and Drying:

- Drying: After being dyed or printed, the cloth is dried on a tenter frame. Hot air is blown on the cloth as it travels in open width through the machine. Some fabrics are dried on an air lay-dryer.
- Singeing: Some styles of cloth are passed over a gasoline flame to remove excess fibers from the cloth.
- Washing: Printed cloth and Pad Batch dyed cloth must be washed. A rope washer with a pad and three washing units are utilized for the operation. The cloth is then dried on one of the tenter frames.
- Finishing: The cloth is padded with a finish material such as a softener to enhance the feel of the cloth, and then dried on the tenter.
- Sanforizing: Cotton fabrics must be sanforized to improve the shrinkage characteristics when garments are washed. The fabrics are sprayed with water and passed through a rubber blanket pressing against a hot cylinder.



Implemented (proposed) modifications in the Mercerization Line

- Inspection:The cloth is inspected. Defects are removed before the cloth is cut and sewn into garments.

Plant Services:

- Steam production: Steam is produced by an 8-ton-per-hour fire tube boiler and a 4-ton-per-hour water tube marine boiler. Also two boilers heat Dowtherm used for heating two Bruckner drying frames.

- Water treatment: Water is purchased and is softened for use in the wet processing areas. Further treatment is provided for the boiler water.

Cleaner Production Application

The diagnostic assessment identified 9 pollution prevention actions:

1 Utilize the overflow from steam boxes in the mercertization line in the third caustic soda bath.

2 Utilize the overflow from the pad on the rope washer range as fresh water for the washers. Also countercurrent flow for the rope washers.

3 Install a steamer after the pad on the preparation line.

4 Install a vacuum extractor in front of the Bruckner frame.

5 Repair steam leaks throughout the plant.

6 Convert the singer from gasoline to natural gas.

7 Insulate Dowtherm lines in the dye house.

8 Return the condensate from jet dyeing machines to the boiler.

9 Insulate steam pimes in the boiler house.

Options 3 and 6 are planned for implementation. Option 4 will not be implemented. The other options have been implemented.

Enabling technologies:

- Introduction of a closed cycle heating system in jet machines; and

- Introduction of countercurrent systems both the washing and mercerization lines.

Advantages:

- Improve environmental conditions and reduce fire hazards;

- An 85% reduction in water consumption, from 60 to 9.5 liters per kg of fabric produced; and

- An 18% reduction in fuel consumption (no. 6 fuel oil).

Economic Benefits

The diagnostic assessment identified 9 pollution prevention actions saving BTM at least LE 315,000 in the first year for a total investment of about LE 281,000. Seven of these actions (1, 2, 5-9) yield savings of about LE 90,000 for a cost of about LE 7,000.The majority of the total savings come from 2 recommendations (3, 4) costing about LE 200,000 and LE 75,000 having payback periods of 1 and 4 years respectively.

Country:
Egypt

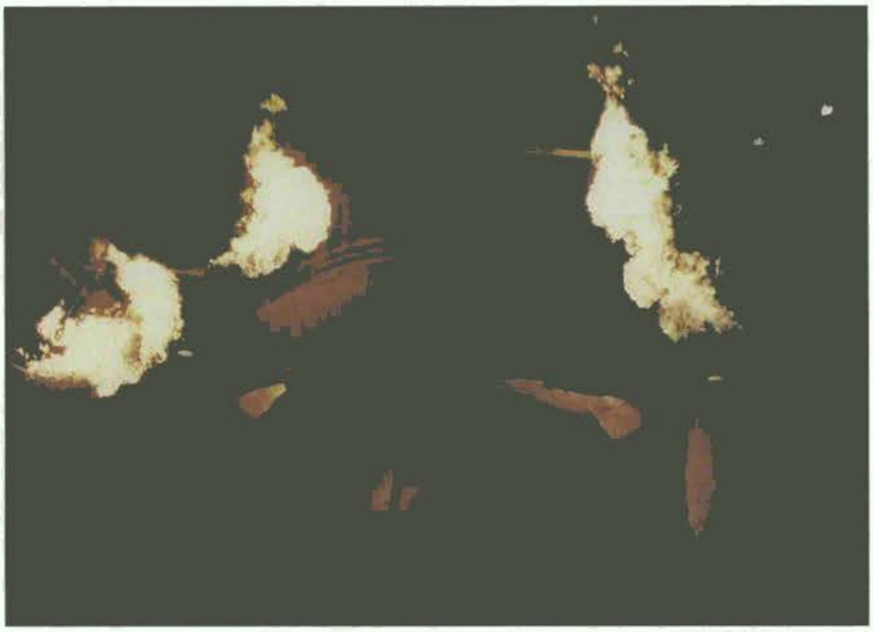
Industry:
Textile

Company:
BTM Co.

Contacts:
Dr. Louis Beshara - Chairman
BTM Co.
Second Industrial Zone, B 2
Tenth of Ramadan City
El Sharkia
Egypt

Tel: + 201 5 362750, 362751, 362752
Fax: + 201 5 362753

Reduction of "Red Smoke" Emissions in a Steelwork



Background

SOLLAC-FOS is one of the three French integrated steelworks. It is part of the USINOR-SACILOR Group, the world's third largest steel producer. Annual production is 4 million tons of steel. This process consumes 2 million tons of oil equivalent (TOE).

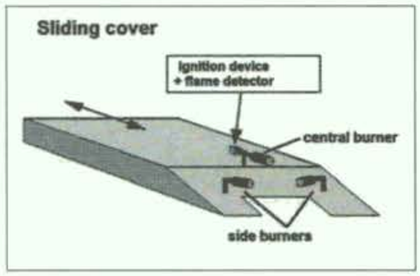
Like all steelworks, SOLLAC-FOS faces a considerable environmental problem, the discharge of « red smoke ». This smoke is laden with iron oxide, pure iron, and carbon dust (in small quantities) resulting from the oxidation of liquid metal during pouring operations at the different stages of the steel production process. Until 1991 this gaseous emission, which annually totaled 4 billion cubic meters containing 2,000 tons of iron oxide dust, was treated by conventional suction and filtration systems. These had the disadvantage of requiring large installations capable of treating several million cubic meters per hour in the converters, which required high maintenance costs and large electricity consumption.

To satisfy new requirements for environmental production, SOLLAC-FOS developed in 1992 a new effective and economic technique consisting of limiting the source of red smoke by avoiding oxidation of the metal. This required elimination of oxygen in contact with the metal by injecting "inertizing" gas into the jet and the molten steel.

Cleaner Production Application

The principle of eliminating red smoke by injecting pure gas directly into the molten metal so as to absorb the oxygen present around the jet was already known. Non-controlled combustion lead to large flames and large consumption of gas, as well as a great deal of heat emission and decrease in visibility for operators.

The Energy and Environment Department at SOLLAC-FOS, in

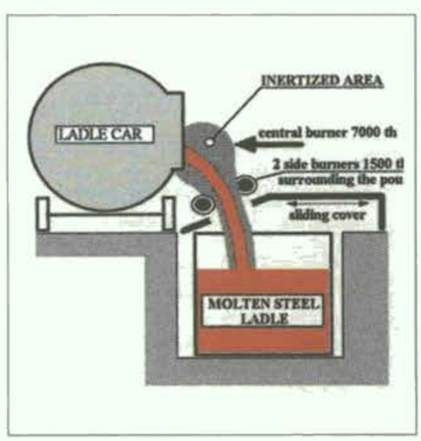


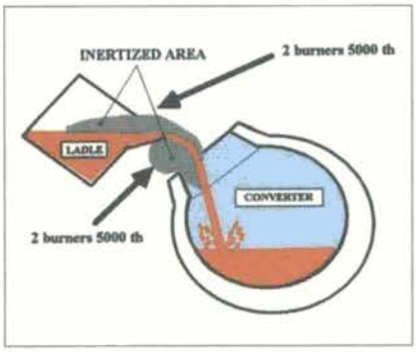
partnership with the Steel and New Works Departments, developed a new intertizing principle involving a liquid metal jet during pouring operations, which has now been patented.

Enabling technologies:

The new principle is implemented by replacing the air around the molten liquid jet by neutral and hot combustion products occupying considerable volume due to the expansion caused by combustion. This prevents movement of air toward the metal. Controlled combustion then makes it possible to minimize the quantity of gas required and therefore causes less local heating of structures while improving visibility.

To accomplish this, air/gas burners are used to provide quality combustion, with good flame control. However, this





sophisticated technique requires substantial knowledge of the phenomena involved in order to locate the impact zone of the combustion products. In 1992 this intertizing technique was tested at SOLLAC-FOS in order to demonstrate the efficiency and feasibility of the system. Three strategic points were selected for testing the system:

- pour into the transfer ladle car at the blast furnace;
- transfer from the ladle car to the ladle at the steelworks; and
- loading of cast iron at the converter

For simplicity, the first tests were carried out using natural gas available at a pressure of 4 bars. After the feasibility tests, SOLLAC-FOS decided to implement the intertizing technique.

In addition to the inertizing system, SOLLAC-FOS modernized the system of offgas collection, and replaced the former pivoting covers carrying the intertizing burners.

Advantages:

- Poured steel: A reduction of up to 80% in the emission of red smoke was observed, with only 40% of the nominal suction flow for absorbing the smoke, and a temperature in the sleeve that was acceptable for bag filters.
- Converter: A reduction in emissions from 6 tons per day to 1 ton per
  day was observed when pouring steel into the converter.

Country
France

Industry
Steel production

Company
SOLLAC-FOS

Contacts
Mr Philippe DOMINI
Thermal Process Manager

Mr Alain USAI
Thermal Studies Assistant

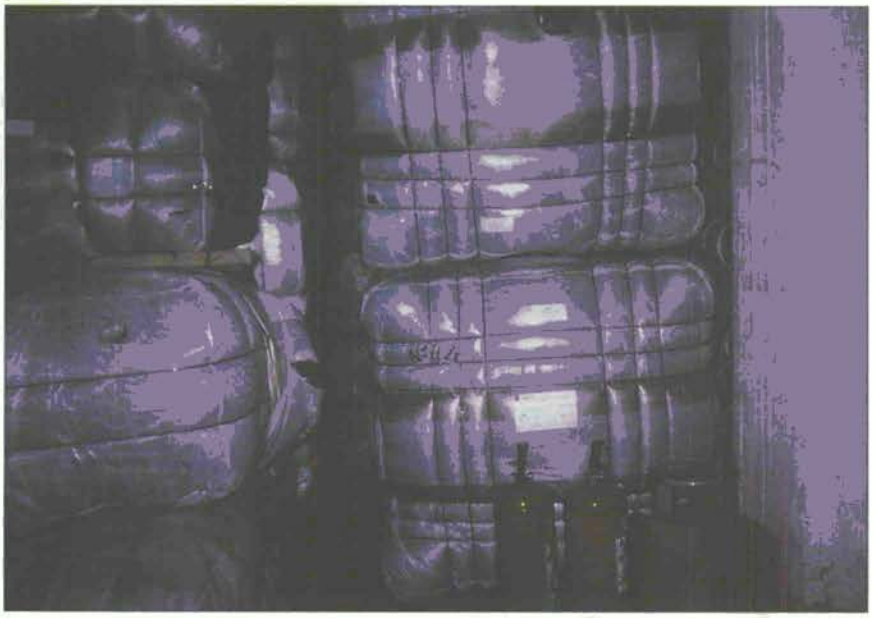
SOLLAC-FOS Stellworks
Blg. EBI
13776 FOS-Sur-Mer Cedes
France

Tel: + 33 42473403
Fax: + 33 42473367

Economic Benefits

Cost Saving	**US Dollars/year**
Energy	**1,430 TOE/year**
Reduced discharges	**8,100 tons/year CO_2**
	14 tons/year SO_2
TOTAL	
Investment	**21 million FF**
Payback period	**—**

Recycling Innovations in a Textile Industry



Background

Pandelidis Textiles produces thread and fabrics from wool and synthetic fibers imported from a variety of countries, including Italy, Germany, France, the U.S.,Turkey and Brazil.
The company employs 55 persons and had sales of 785 million drachmas (2.6 million ECU) in 1994.
The production process includes the following steps:

- Receiving imported raw materials in 0.5-ton packages wrapped with plastic or fabric, paper and wire. Approximately 1,000 kg/year of plastic wrapping material is generated for waste disposal.

- Threading and production of thread. This generates waste of approximately 3 to 4% of the received raw materials.

- Weaving and production of fabrics. Steam with an antistatic component is used for conditioning the threads during the weaving process. Fabrics are wound on rolls and packaged with plastic.Water consumption for this phase of the production process is approximately 1 cubic meter per ton of product. Approximately 2,000 kwh of energy per ton of product is consumed.

Cleaner Production Application

The following cleaner production options were identified and implemented:

- Replacing plastic cones used for winding threads and fabrics with paper cones produced from recycled paper;

- Recycling raw material packaging wastes (mainly plastic);

- Recycling raw material waste from the production of secondary fibers; and

- Recycling of water condensate from steam production and from the roof of the building for use in the fire protection system.

Enabling Technologies

The following technologies were employed:

- Paper cones for winding threads and fabrics are produced by a Greek company from recycled paper;

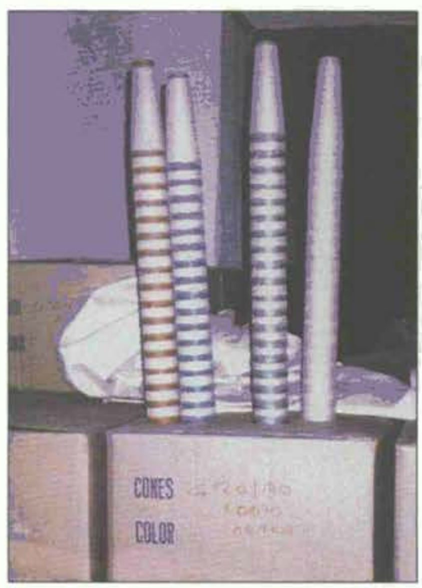
- Raw material wastes are recycled using vacuum collection devices operating continuously in front of the weaving machines;

- Raw material packaging wastes (plastic) are separated from other wastes and compacted in an 8-ton press to reduce volume, (the plastic can then be recycled); and.

- Water is recycled to the fire protection system through the existing drainage system.

Advantages:

- The use of paper cones instead of plastic ones is preferable for increased stability in winding threads.This results in less harm to



the threads and decreases costs by about 50%.

- Recycling packaging wastes reduces the cost of solid waste disposal, and has potential income from selling the wastes. Recycling these wastes would reduce by 95% the annual total quantity of solid disposal.

- Recycling process waste water produces savings in fresh water supply and increases autonomy of the fire water system. There is no direct economic benefit.

- The use of recycled plastic for wrapping products is more practical and less costly than previous wrapping.

Economic Benefits

Cost Saving	ECU/year	DRS/year
Recycling waste raw material	7,500	2,250,000
Use of paper cones	5,500	1,660,000
Recycling packaging materials (potential)	200	60,000
Water savings	none	none
TOTAL	13,200	3,960,000
Investment	none	
Payback period	not applicable	

Country
Greece

Industry
Textile

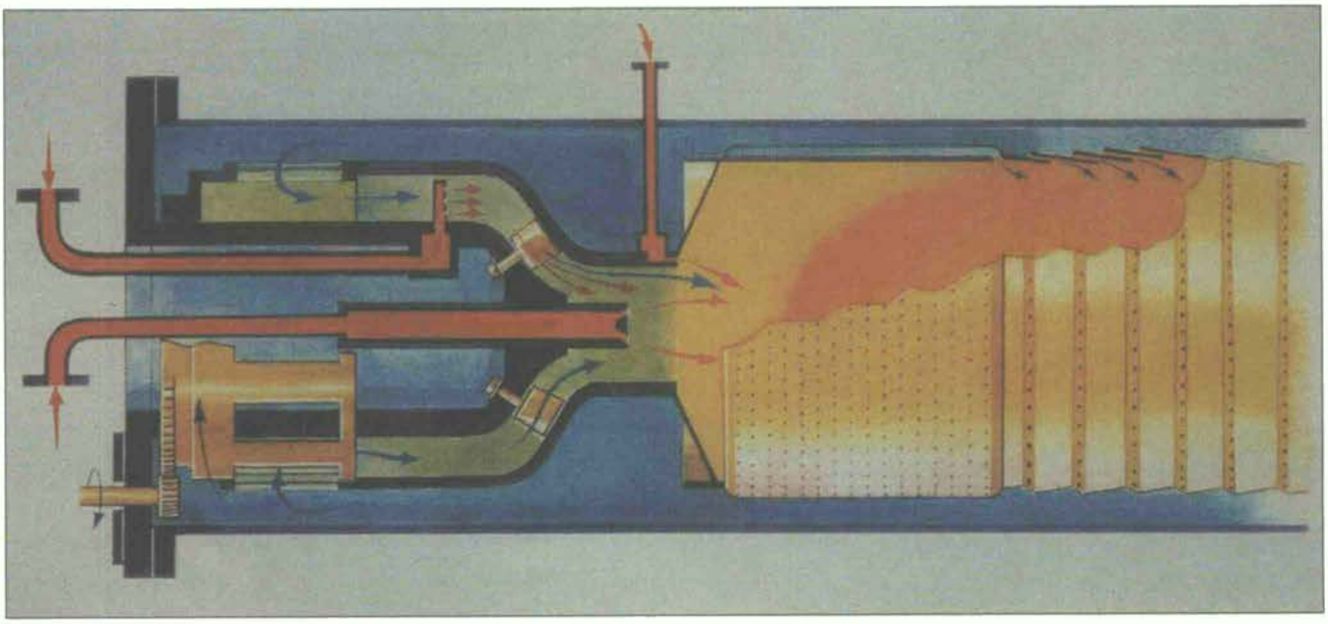
Company
Pandelidis Textiles S.A.

Contacts

Mr Argiris Pandelidis
Managing Director
Pandelidis Textiles SA
12th. Km. of National road - Athens-Lamia
Athens 14451
Greece

Tel: + 30 1 2818429
Fax: + 30 1 2831212

Dry Low-NOx Combustion System for Heavy Duty Gas Turbines in Gas Compressor Stations



Background

SNAM is a company in the ENI Group responsible for the supply, transportation and large scale distribution of natural gas. It has a gasline network of some 26,000 km which supplies natural gas to industrial customers and to gas distribution companies. The network is powered by compressor stations throughout Italy which employ gas turbines that use natural gas as a fuel and also produce air pollutants.

The new technology provider, Nuovo Pignone, is a turbomachinery company owned by General Electric Co. Their products include process compressors, pumps turbines, and valves and control systems.

Cleaner Production Application

In two SNAM gas compressor stations, conventional fixed geometry combustion chambers of two gas turbines were replaced with dry low-NOx chambers with variable geometry combustion systems. Air mass flow used for combustion is continuously adjusted to the thermal load to control flame temperature.

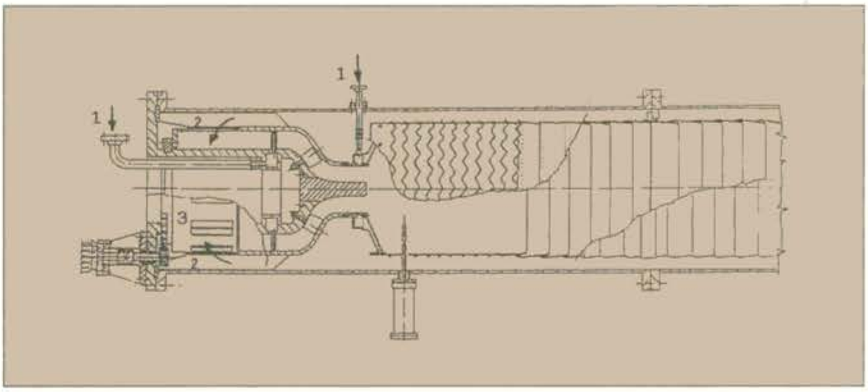
The dry low-NOx technique decreases flame temperature and thermal NOx by controlling geometry in the combustion chamber. Emissions of NOx are dramatically reduced without steam or water injection and without flue gas treatment.

Enabling Technology

Conventional combustion systems use high flame temperature, resulting in high NOx production. In the modified system, air and natural gas are mixed together to form a mixture which burns at a much lower temperature and thereby reducing NOx emissions.

Advantages

NOx emissions are reduced from about 200 ppmvd (corrected to 15% 02) to 35 ppmvd and CO emissions are also reduced. Routine maintenance of the gas turbine is not affected, so there are no extra-costs for servicing.



Country
Italy

Industry
Natural Gas

Company
SNAM

Contacts:

Mr Angelo Riva
R&D Manager for Safety, Environment and Natural Gas Utilization
SNAM S.p.A.
Piazza Vanoni, 1
20097 San Donato, Milan
Italy

Tel: + 39 2 520 7934
Fax: + 39 2 520 38133

Technology Supplier

Mr Luciano Bonciani
Nuovo Pignone S.p.A.
Via F. Matteucci, 2
50127 Florence
Italy

Tel: + 39 55 4233518
Fax: + 30 55 4232800

Reducing Chemicals in the Production of Deionized Water

Background

SGS-Thomson Microelectronics manufactures high-end semiconductor devices. The Malta facility is ultra-modern with Class 10,000 and 1,000 clean room conditions in the manufacturing areas. The electronics sector has become one of Malta's most important export industries.

The production process requires extremely pure deionized water. The purification of city water for the production of deionized water involves a sequence of purification steps to achieve the required grade of process water. The steps include reverse osmosis and ion exchange.

The reverse osmosis unit reduces total dissolved solids from 4,000 to 200 ppm. The ion exchange resin is periodically rinsed with water and regenerated with sodium hydroxide ($NaOH$) and hydrochloric acid (HCl).

Cleaner Production Application

Corporate SGS-Thomson environmental audits and assessments are conducted for all SGS-Thomson affiliates. SGS-Thomson (Malta) has an environmental steering committee, chaired by the general manager, that periodically meets to consider cleaner production alternatives.

SGS-Thomson (Malta) was concerned about the environmental and financial costs of the deionized water supply. Deionized water is used in some of the electroplating processes and by the tools cut electronic "wafers". The relatively high salinity of the city water was putting a high load on the ion-exchange system and requiring considerable amounts of chemicals.

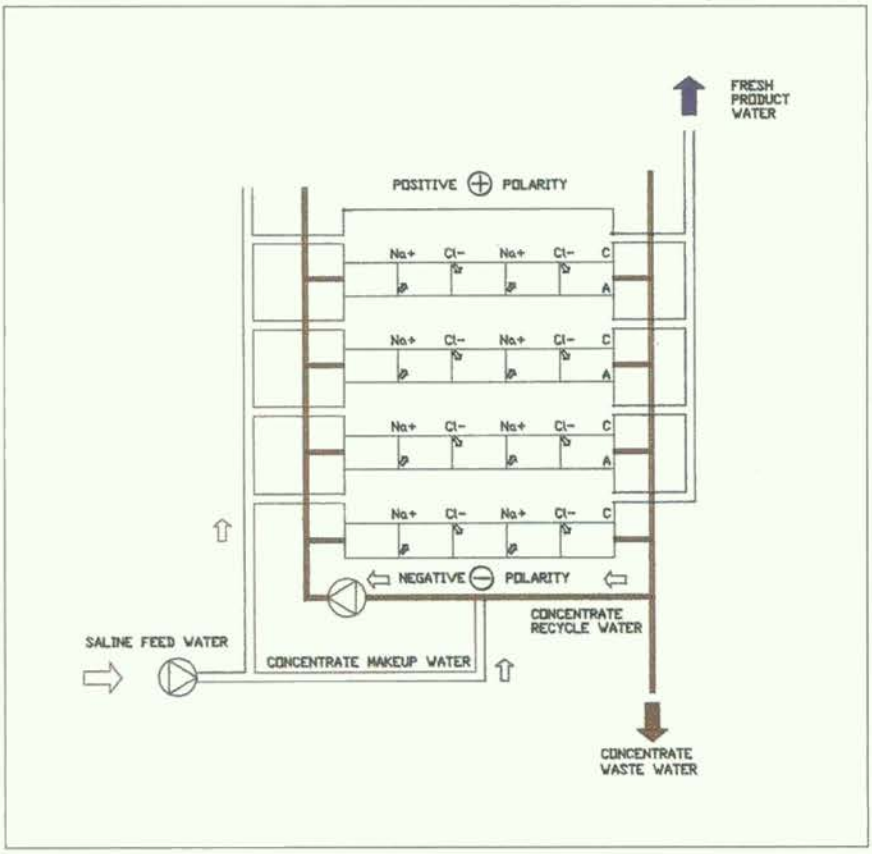
SGS-Thomson investigated using a reverse electrodialysis process for removing dissolved solids from city water upstream of the reverse osmosis unit. The reverse electrodialysis unit was installed in 1989.

SGS-Thomson (Malta) is currently conducting a related project with the goal of reducing water intake at the plant by 80%, through recycling water from the reverse electrodialysis to the process and the sanitary water supply.

Enabling technologies:

The reverse electrodialysis process is based on the classical electrodialysis process in which water flows between alternately placed cation and anion transfer membranes at low hydraulic pressure. A direct current charge passes through the membrane array selectively transferring ions (dissolved salt in water containing a positive or negative electrical charge) through membranes by means of ion electrical charge (cation or anion). This results in depleting or concentrating salts or ions in the alternating water layers between membranes.

In the reverse electrodialysis process the electrical polarity, the demineralized and concentrate flow passages, are automatically reversed three to four times per hour. The ion movement direction is thus reversed, providing an "electrical flushing" of scale forming ions and colloidal matter from the membranes thereby eliminating the need for pre-treatment.



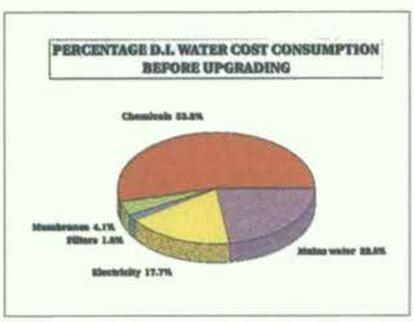
High recoveries are achieved through controlled recirculation and blowdown of the concentrate stream.

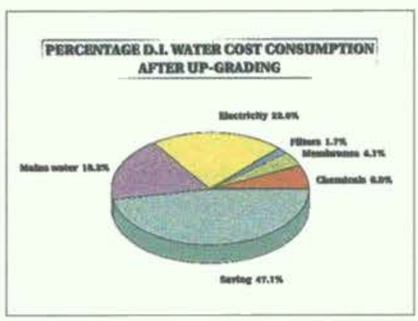
The reverse electrodialysis unit, supplied by IONICS-ITALBA (Italy), reduces totally dissolved solids in the raw water stream entering the plant to 600 ppm. The reverse osmosis system further reduces dissolved solids to 30 ppm. This considerably lengthens the operating cycle on the ion exchange column between regeneration of the resin. A drastic reduction in consumption of chemicals is also achieved.

Advantages:

The implementation of this process has resulted in:

- Reduction in the use of NaOH and HCl by 90%;
- Less handling and storage of hazardous chemicals;
- Higher reverse osmosis feed water flow rates (20% higher);
- Reverse osmosis membranes require less frequent cleaning and last longer;
- Anti-scaling dosing for the reverse osmosis unit is eliminated due to the reduction in total dissolved solids entering the unit; and
- Reduction in the use of rinse and process waste water in the ion exchange column due to the longer operating cycle. Also, there is less frequent disposal of spent resin to the municipal landfill.





Country
Malta

Industry
Electronics

Company
SGS-Thomson Microelectronics (Malta) Ltd.

Contacts:
Mr Gene Gretchen
General Manager
SGS-Thomson Microelectronics Ltd.

Mr Ray Piscopo
Facilities Manager
SGS-Thomson Microelectronics Ltd.

Industry Road
Kirkop
Malta ZRQ 10

Tel: + 356 682181
Fax: + 356 680371

Economic Benefits

The new process reduced the percentage cost of chemicals used for producing deionized water from 53.8% to 6.9%. Water consumption dropped as well. The consumption of electricity rose slightly to 22%.

Cost Saving	**Dollars/year**
TOTAL	**50,630**
Investment	**275,400**
Payback period	**5.4 years**

Good Housekeeping Practices in a Food Processing Plant

Background

CPC Spain is a member of the multinational group CPC International Inc. and is a major producer of corn and other food products. CPC Spain has supported waste minimization strategies in its production processes, and has set up an environmental improvement team. This team has been the key factor in achieving the following results: quantifying generated waste and assessing its economic impact for the company; identifying sources of waste and the basic causes for their generation; implementing technological changes, new working procedures and training regarding good practices; and evaluating the potential for resource recovery.

The CPC Spain food product facility combines vegetable oil, vinegar and pasteurized eggs to produce mayonnaise. The delivery of ingredients from storage tanks to a mixing tank by pumps is controlled by a pressure and level control system. Mayonnaise product is pumped to a packaging unit.

The mayonnaise production process equipment is periodically cleaned. Water is flushed through the piping, waste water containing mayonnaise and drained to the sewer, resulting in high levels of biological oxygen demand (BOD).

Cleaner Production Application

The environmental improvement team proposed an improvement based on the design of a silicone ball that can be propelled by air through piping, pushing mayonnaise into the bottle filling machine. In this way, mayonnaise that would normally be part of the process waste water stream is saved and sold as product.

Enabling Technologies

For implementing the cleaner production system, the following was necessary:

- Design the silicone ball to push the mayonnaise product through the piping;
- Implement minor piping system, modifications to avoid blocking the ball;
- Relocate some process sensors;
- Install pressurized air supply near the piping; and

- Train operators to operate and maintain the new system.

Advantages:
The changes have the following advantages:

- Reduce waste stream by about 20 tons per year (5 to 7 tons per year of this former waste stream is mayonnaise recovered from piping; the remainder is rinse water that is no longer necessary);
- Reduce waste treatment and disposal costs; and
- Recover value of saleable materials (this is recovered mayonnaise, which is sold as animal feed).

Economic Benefits

Cost Saving	US Dollars/year
Labor	22,400
Water	4,400
Chemical products	14,392
Energy	(11,200)
Maintenance	1,200
Environmental penalties	2,880
Sludge disposal	2,800
TOTAL	36,872
Investment	216,000
Payback period	6 years

Country
Spain

Industry
Food Processing

Company
CPC Spain

Contacts
Centre for Cleaner Production Initiatives
Departamento de Medi Ambient
Generalitat de Catalunya
Travessara de Gracia, 56 4t.
08006 Barcelona
Spain

Tel: + 34 3 4147090
Fax: + 34 3 4144582
e-mail:A03227@servicom.es

Striving for Zero Water Waste in a Metal Finishing Facility

Background

Electroless Hard Coat is a metal finishing company specializing in surface coating metal pieces and structural elements for the aeronautics, automobile, telephone and computer industries. The company has a staff of 15 persons.

The metal finishing process includes two consecutive steps:

- Stage 1 - surface cleaning and preparation using degreasing solutions (alkaline, chemical and ultrasound) and acid solutions (nitric and sulfuric) to eliminate residual oxides and greases.

- Stage 2 - immersion of the metal parts in a solution containing ions of the coating metals (Zn, Cr and Ni).

The principal pollutants are in the process rinse waters generated by treated surface washing (alkaline, acid cyanide chrome and heavy metals) and spent chemical baths. The company installed a physical-chemical treatment plant and an industrial water recovery system for reducing the environmental impacts of the pollution.
The main problem with process waste water treatment was the partial contamination of waste water effluent and the generation of large quantities of sludge containing heavy metals and chemical compounds.

Cleaner Production Application

A new technology based on a vacuum evaporator for water effluent and treatment of spent chemical baths was developed. It replaces the major part of the traditional physical-chemical treatment plant.

Enabling Technologies

The technology features an economic evaporation process consisting of a pressurized electric heating pump.
A cooling system condenses steam from the evaporation process, resulting in distilled water that can be reused in the industrial process. The waste water stream in considerably reduced in volume.

Advantages

The changes have the following advantages:

- A 100% reduction in water consumption and zero discharge;

- A 97% savings in chemical products formerly used for conventional water treatment and control;

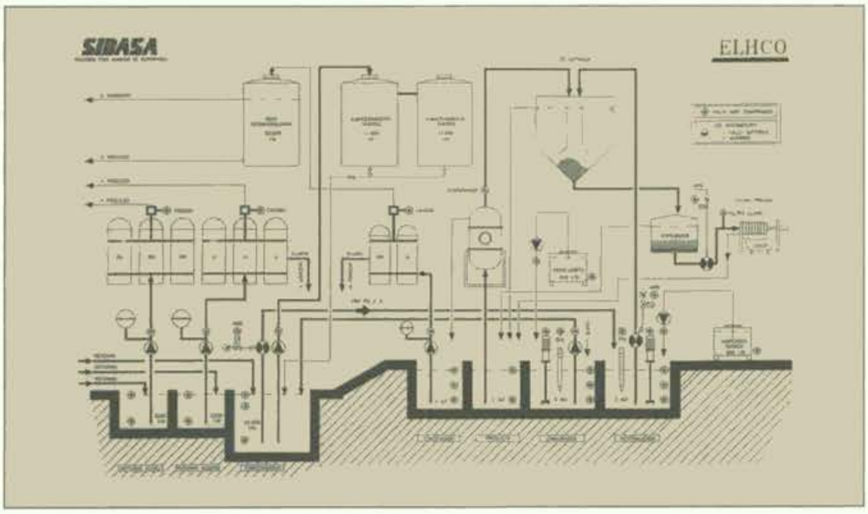
- A 80% savings in labor costs due to the reduction of water treatment and sludge disposal operations;

- A 90% reduction of sludge produced by conventional water treatment;

- Elimination of environmental penalties due to water emissions exceeding limits, and elimination of the cost of related analytical controls;

- Improved pubiic image due to reduction of contamination in water emissions; and

- Quality improvement in the final product to the use of distilled water (from the evaporator) in the rinse systems.



Economic Benefits	
Cost Saving	**US Dollars/year**
Waste reduction	**9,600**
TOTAL	**9,600**
Investment	**4,000**
Payback period	**2.4 years**

Country
Spain

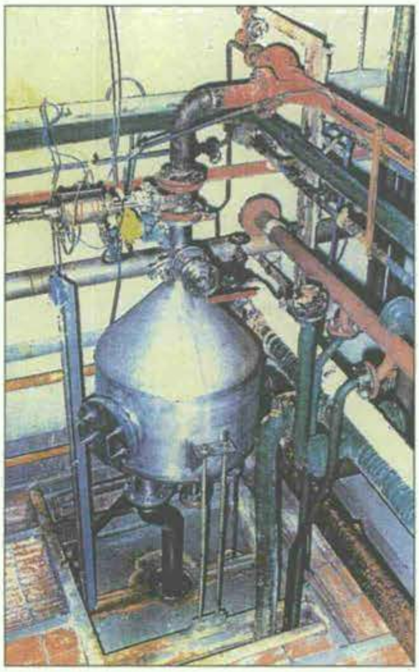
Industry
Metal Finishing

Company
Electroless Hard Coat S.A.

Contacts
Centre for Cleaner Production
Initiatives Departamento de Medi
Ambient Generalitat de Catalunya
Travessara de Gracia, 56 4t
08006 Barcelona
Spain

Tel: + 34 3 4147090
Fax: + 34 3 4144582
e-mail:A03227@servicom.es

Material Reuse in a Textile Plant



Background

Nylstar, founded in 1923, produces polymers and synthetic fibers and filaments. The company has 633 employees and turnover of US$ 109 million, and is a joint venture of Rhone-Poulenc and Snia Fibre. Nylstar produced 28,706 tons of polyester in 1994.

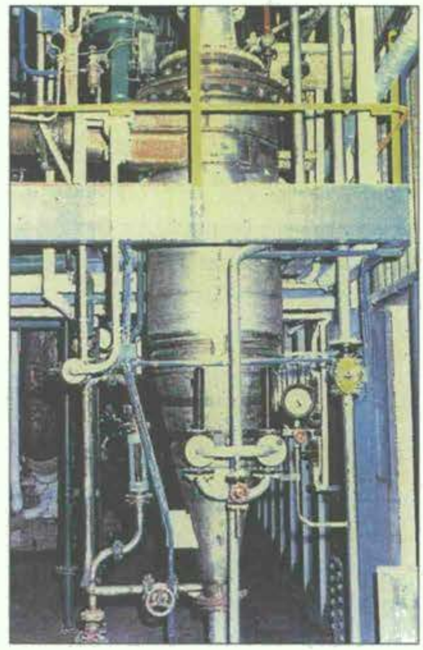
Polyester is a synthetic fibre obtained through the reaction of glycol and dimethylterephthalate. Both reagents are heated, combined and processed, first in the transesterification reactor, and then in the condensation reactor. An excess of glycol contaminated with polyethilenterephthalate monomer and methanol are the reaction byproducts. The mixture of glycol and monomer is normally distilled, obtaining glycol that can be processed for reuse, creating a waste stream composed mainly of monomer. The monomer had to be treated before being disposed, and increases water consumption in the distillation unit.

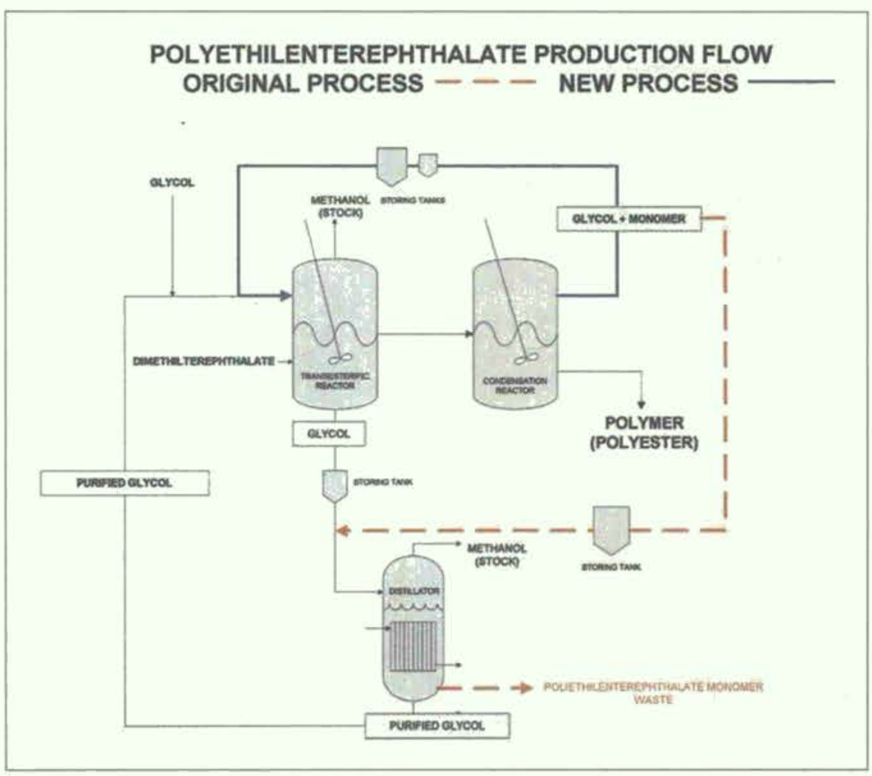
Cleaner Production Application

At the end of 1994, Nylstar undertook a minor but significant modification within the process. The objective was to reuse the mixture within the transesterfication reactor to optimize raw material consumption. This mixture, composed of glycol and polyethilenterephthalate monomer, obtained from the polycondensation reactor, is fed directly to the first reactor. This avoids distillation of the mixture and the generation of a monomer waste stream. These measures were implemented due to company environmental policy and the savings potential.

Enabling Technologies

The cleaner production solutions were possible thanks to Nylstar's understanding of the production processes. Nylstar also conducted research on possible changes to the polyester polymer product due to the use of glycol and monomer instead of simple glycol.





Advantages

- Waste minimization: The original process generated approximately 33.4 tons per year of waste. The new process generates only 1.4 tons per year;
- Decrease in raw material consumption: The new process reduced raw material use by 32 tons per year. The new process has also reduced catalyst consumption by 2 tons per year;
- Reduction of treatment and disposal costs; and
- Reduced energy costs: This resulted from the elimination of the distillation step for the glycol and monomer mixture.

Country
Spain

Industry
Textile

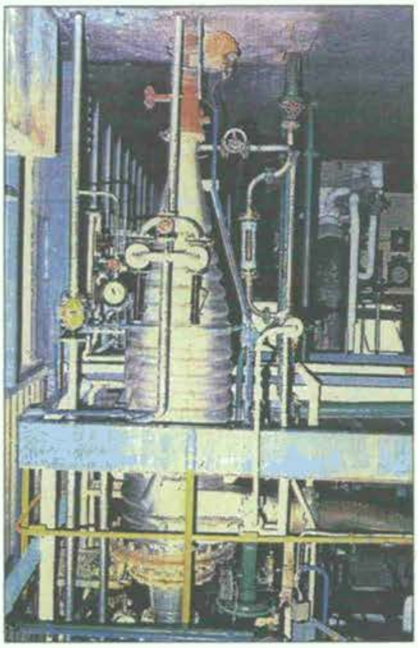
Company
Nylstar S.A.

Contacts
Centre for Cleaner Production Initiatives
Departamento de Medi Ambient
Generalitat de Catalunya
Travessara de Gracia, 56 4t.
08006 Barcelona
Spain

Tel: + 34 3 4147090
Fax: + 34 3 4144582
e-mail:A03227@servicom.es

Economic Benefits

Cost Saving	
Raw materials	**23,456 US$/year**
Electricity consumption	**17,710 kwh/year**
Steam consumption savings	**1,075 tons/year**
Water consumption savings	**13,522 tons/year**
Waste treatment savings	**1,635 US$/year**
TOTAL	
Investment	**68,000 US$**
Payback period	**13 months**



Striving for Zero Discharge in an Aluminum Treatment Plant

Background

Aluminum treatment plants produce a considerable quantity of sludge because of the chemical solutions used. Primarily, when treating hard-draining surfaces there are large quantities of chemical concentrated drag-out.

Existing waste water treatment plants generally are based on equalization, neutralization and precipitation. The final generated sludge must then be thickened and dewatered.
Effluent treatment by hydroxide precipitation is still widely used, even though difficulties related to such techniques are documented.

In essence, the classic treatment by precipitation does not decrease pollution. It transfers it from a liquid phase to a solid phase. A preventive approach would consider the following criteria:

- Chemicals for aluminum treatment should be low or not toxic (for example, biodegradable chemicals not containing phosphates, silicates, or chromium);
- Separation, recovering and recycling equipment appropriately at each phase to maximize production efficiency; and
- Minimized effluent treatment.

RECOAL system, a research technology developed by SIDASA, permits achievement of these new demanding targets.

Cleaner Production Application

The RECOAL system makes possible separation of aluminum from the etching bath and the anodizing bath, and recovery of sodium hydroxide and sulfuric acid. It is also possible to recovery a significant portion of rinsing water.

Enabling technologies:

The RECOAL system integrates a number of technologies, including:

- ion exchange;
- ionic retardation; and
- membrane separation

Advantages:

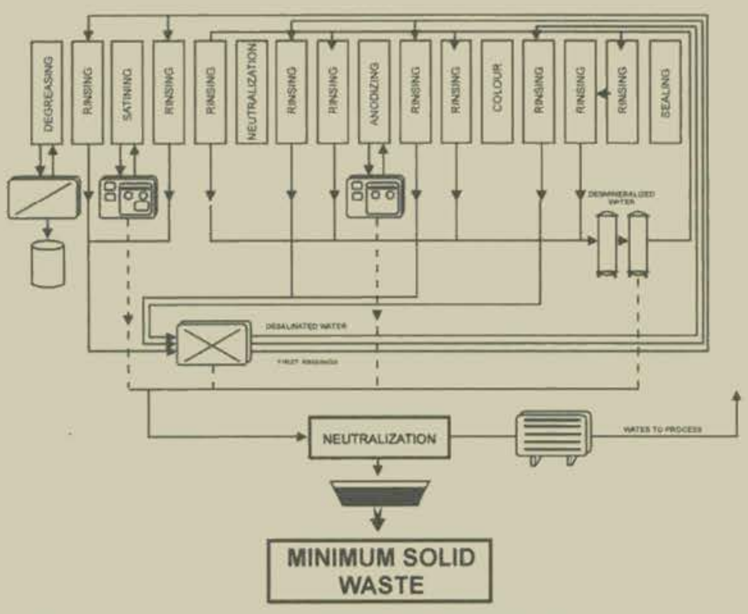
- A 70% reduction of sludge produced by the treatment plant.
- Savings of 20% in consumption of water, 60% in consumption of sodium hydroxide, and 60% in consumption of sulfuric acid.

Economic Benefits

Cost Saving	US dollars per year
Sulfuric acid	40,000
Sodium hydroxide	72,000
Water	48,000
Sludge disposal	80,000
TOTAL	240,000
Investment	400,000
Payback period	20 months

RECOAL SYSTEM

NEW TECHNOLOGY FOR THE REDUCTION OF WASTES TO A MINIMUM IN ALUMINIUM ANODIZING PLANTS



		ANNUAL CONSUMPTION		
PRODUCT	UNIT	CONVENTIONAL	RECOAL	SAVING
SULPHURIC ACID	Tn/year	160	56	65%
CAUSTIC SODA 50%	Tn/year	260	130	50%
WATER	m^3/year	35.000	7000	80%
CALCIUM HYDROXIDE	Tn/year	17,5	6	65%
SLUDGE PRODUCTION	Tn/year	865	410	53%

Country
Spain

Industry
Metal finishing

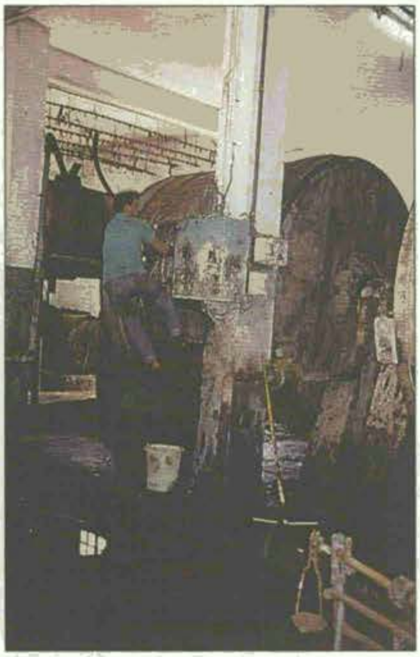
Company
DECORAL, S.A. - SIDASA

Contacts

Centre for Cleaner Production Initiatives
Departamento de Medi Ambient
Generalitat de Catalunya
Travessara de Gracia, 56 4t.
08006 Barcelona
Spain

Tel: + 34 3 4147090
Fax: + 34 3 4144582
e-mail:A03227@servicom.es

Less Toxic Wastes in a Leather Tanning Process



Background

The sheepskin tanning process includes the following steps:

- Soaking skins for 48 hours in ambient temperature fresh water to remove blood, manure and dirt from the hides;
- Dewooling by painting the hides with lime and sodium sulfate solution, curing for 7 hours and removing the wool using a mechanical hair-pulling machine;
- Liming for 24 hours to dissolve the epidermis, any remaining hair and any other remaining undesirable compounds in or on the hides;
- Fleshing by pressing by a roller and shaving by a blade adjacent to the roller;
- Neutralizing with a solution of fresh water, ammonium salts, enzymes and organic salts;
- Preparing for pickling by addition of emulsifiers, non-solvent degreasing agents, salt, formic acid and sulfuric acid to lower the pH to the 2.8 - 3.0 range;
- Tanning by adding chromium sulfate salts and sodium bicarbonate sequentially and mixing for 2 hours and 4 hours, respectively;
- Post-tanning by aging for 24 hours and rinsing and degreasing;
- Dyeing and conditioning using fat liquoring agents to give the leather its supple feel; and
- Finishing by trimming, stretching out and pinning onto a light metal grill and drying to the desired final moisture. Depending on the final use of the hides, an automatic system sprays pigments, resin binders and waxes onto the grain side of the hides. The finished hides are shaved, ironed, inspected and hand-trimmed to their final size.

Currently the plant suffers from a number of pollution problems including:

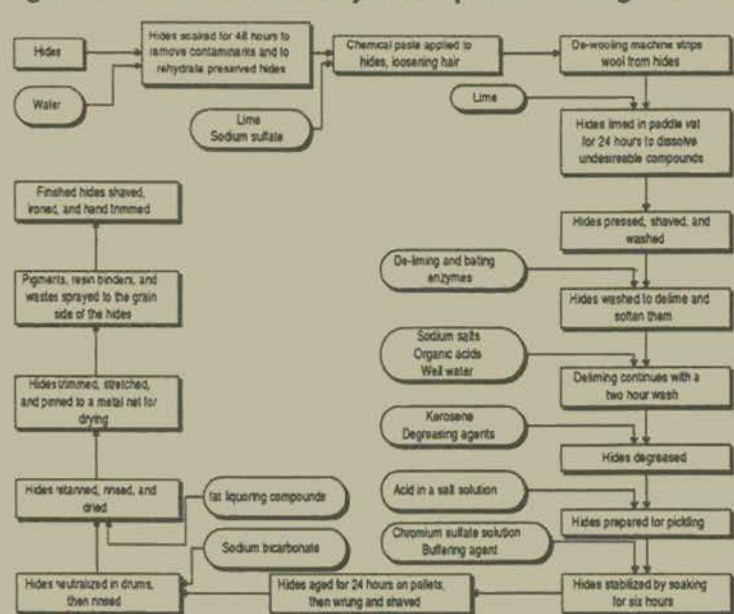
- sulfide generation;
- excessive chromium discharge;
- excessive effluent volume;
- inefficient chromium fixation; and
- inefficient use of dye chemicals.

Cleaner Production Application

Four pollution prevention opportunities that could address these problems were identified:

- segregate the liming and washing wastewaters to eliminate sulfide generation;
- increase temperature and control

Figure 1: Overview of Facility's Sheepskin Tanning Process



the pH of the tanning baths to increase chromium fixation on the hides;

- recycle used chromium effluent with addition of 1/3 of initial requirements to reduce chromium discharge to the wastewater; and

- recycle used black dye solution with addition of 1/2 of initial requirements to reduce the dye discharge into the wastewaters.

Enabling Technologies

- Construct a sump that can intercept wastewater from the liming and washing operations and oxidize the sulfides before mixing with acidic waste streams.

- Repair boiler to reheat the tanning bath, install continuous, digital temperature and pH probes for each bath.

Advantages

- Zero production of sulfides and foul smells;

- Consumption of chromium sulfate is reduced to 1/4 original consumption; and

- Consumption of black dye is reduced to 3/4 the original consumption.

Economic Benefits

Cost Saving	US Dollars/year
Chromium recycling	40,000
Dye Recycling	10,000
TOTAL	50,000
Investment	20,000
Payback period	5 months

Country
Tunisia

Industry
Leather Tanning

Contacts
Environmental Pollution Prevention Programme (EP3) Tunisia
75 Avenue Mohamed V
1002 Tunis - Belvedere
Tunisia

Tel: + 216 1 788244 or 786680
Fax: + 216 1 787 245
Email: Balih@EP3.TN

Conserving Resources in a Textile Dyeing Facility

Background

This facility treats woven and knitted fabrics of polyester, polyester/cellulosic blends, and cotton blends. The majority of dyes used are disperse and reactive types, with some direct and sulfur dyes which are used on cellulosic fibers, and acid dyes for other fibers.

Fabrics undergo a variety of processes in the machines depending on consumer requirements: scouring; bleaching; dying; and rinsing. Not all processes are carried out on all fabrics.

- Scouring is carried out with detergent and sodium carbonate at 80°C, followed by 2 rinses. Caustic soda treatment is carried out when required after scouring with caustic soda at 120°C. The treatment is finished with cooling, overflow rinsing, and a neutralization.

- Bleaching of cellulosic fibers and polyester cellulose blends is carried out with hydrogen peroxide and appropriate stabilizers and other auxiliaries at 95°C. After cooling, the fabric is hot and cold rinsed.

- Dyeing of polyester is conducted with dispersing and anti-foaming agents at 130°C. After dying a hot rinse is followed by overflow rinsing. Dyeing of cotton is carried out at 69°C. Salt and sodium carbonate are the auxiliary used. A hot rinse, a soaping, and overflow rinsing complete the treatment. Polyester/cellulosic blends are dyed with a two-bath, two-step process, with the polyester component dyed first, and an overflow rinsing between the two steps.

- Centrifuging fabric extracts water from the fabrics.

- Depending on the clients the fabrics may be finished by passing them through a Buckner tenter frame. Fabrics may also be dried and heat set, or finished with softeners and/or hand builders. A second, loop dryer and finishing applicator is used for 100% cotton in a relaxed state. The finished fabrics are inspected and wrapped and stored for shipment.

The facility faced several pollution problems including:

- excessive use of water,
- inefficient use of energy,
- no condensate water recycling, and
- excessive use of chemicals increasing the risk of worker exposure.

Cleaner Production Application

Six cleaner production opportunities were identified:

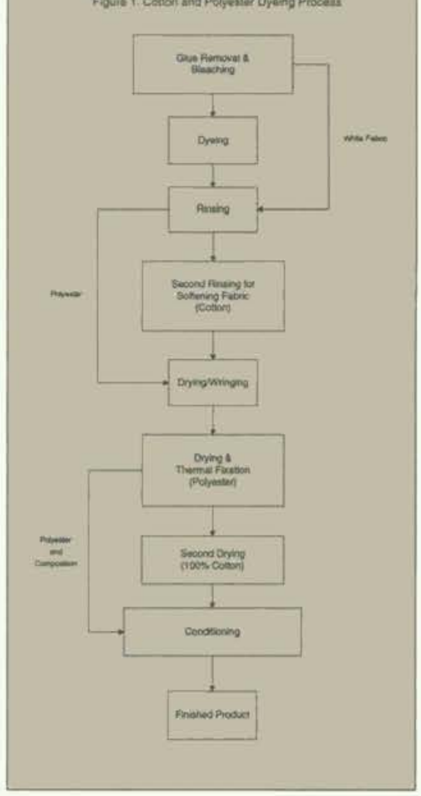
- Maintenance: Fix all leaks in steam lines, condensate return lines, process/cooling water supply lines, and cooling water return lines. This includes: fixing all associated values gauges, traps fittings, and connections; redesigning the piping system to include isolation valves; replacing existing lines and hardware with higher grade material; repairing the broken dryer vent fan; and replacing filler with appropriate covering.

- Laboratory analysis: On an ongoing basis, analyze cooling water return to verify that it is usable as process make-up water; and analyze condensate return to verify that it is usable as boiler-feed water; analyze public water supply for direct use in less critical processes.

- Water recycling: Purchase and install tank and plumbing to collect hot return cooling water; use hot return cooling water as separate hot bath make-up; and reuse final rinse water from certain baths as feed for appropriate scouring and/or dyeing steps.

- Reduce energy consumption:

Figure 1. Cotton and Polyester Dyeing Process



Purchase and install heat exchanger to recover energy from hot discharged dye baths and a vacuum slot de-watering machine for the inlet to dryer; and optimize dryer operations by temperature and/or moisture monitoring.

- Space reorganization: Acquire additional off-site floor space for grey fabric storage and possibly finished goods inspection and storage and construct an appropriate drug room in the vacated portion of the former shipping and receiving area.

- Process optimization and quality control program institution: Minimize chemical use; verify the accuracy of dye and chemical dispensing; empty and wash all plastic chemical containers and use these chemicals in process baths; examine one-bath processes for polyester-cotton blend dyeing; eliminate unnecessary rinsing; and re-evaluate softened water requirements and process water quantities.

Enabling Technologies

Almost all of the recommendations deal with good house-keeping practices and process optimization with existing technology and equipment The only recommendation that requires new technology is the heat recovery with the introduction of a heat exchanger.

Advantages

- Improved worker safety by reducing their exposure to chemicals, dyes and live steam and minimizing electric shock potential;

- Reduced water consumption, COD and pH of effluent as well as the capital cost for waste water pre-treatment station;

- Eliminated corrosion products from condensate and cooling water return lines;

- Increased heating efficiency, thus reducing on-site energy consumption;

- Reduced chemical consumption;

- Improved quality and increased quantity of the products.

Country
Tunisia

Industry
Textile

Contact
Environmental Pollution Prevention Programme
EP3 Tunisia
75 Avenue Mohamed V
1002 Tunis - Belvedere
Tunisia

Tel: + 216 1 788244 or 786680
Fax: + 216 1 787 245
Email: Balih@EP3.TN

Economic Benefits

Cost Saving	**$/year**
Water consumption reduction	**65,000**
Energy consumption reduction	**30,000**
Chemical consumption reduction	**10,000**
TOTAL	**105,000**
Investment	**95,000**
Payback period	**11 months**

Cleaner Production in an Electroplating Facility

Background
The facility is an electroplater that performs zinc, nickel, brass and chrome plating. The facility operations can be divided into five main steps:

1) Polishing: Manual polishing takes place in a separated room. Two to three workers sit at electric polishing machines that look like stationary belt sanders and polish bars and other large pieces before they are plated. They use a red polishing paste to apply abrasives to the belts. The paste comes in brick form and consists of aluminum and silica and fatty acids that act as binders. The fatty acids that must be removed in the cleaning process. Dust generated by the polishing process is collected using vacuums connected to each machine.

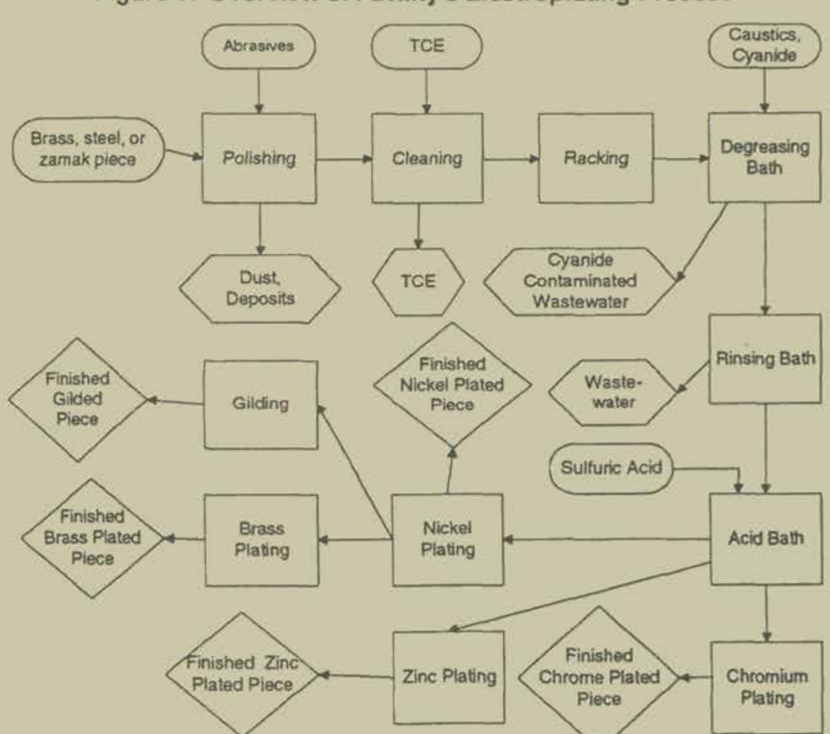
2) Cleaning: Prior to electroplating many parts are cleaned in a vapor degreaser that uses trichloroethylene (TCE) to remove grease and other impurities. Parts are removed from the degreaser, dried with paper towels and tied to racks before being placed in a queue for plating. The degreaser is heated so that TCE vapors rather than the liquid remove the grease. However, the degreaser does not currently function in this manner, and parts are placed in baskets, dipped in the liquid and removed. There is considerable drag-out from this operation, and worker exposure to TCE is quite high.

3) Racking: The facility electroplates any different kinds of parts. Many small pieces are plated in baskets that are placed directly in the solutions. Other parts are hung on special racks that are specifically constructed. After plating, the racks are dismantled, and the copper wire and excess plating solution that forms on the metal rack and wire are removed and collected for resale.

4) Electroplating: The facility electroplates three different metals; approximately 60 percent of its substrate is brass, 30 percent is steel, and 10 percent is zamak. The electroplating line consists of washing tanks, rinsing tanks, and nickel and chrome plating baths and recuperation baths. A copper cyanide bath is located across from the line and is used to plate the zamak before it is plated with nickel and chrome.

All plating is manual. Times are not exact, and there is considerable variation in soaking times among parts and workers. Workers generally place the parts first in a degreasing bath that contains caustic and cyanide in a heated solution. Parts are then rinsed in a continuous rinsing tank and placed in a stripping/pickling bath. Workers quickly rinse the part in a static rinse bath, place the part in an acid (H_2SO_4) bath, dip it in a continuous rinse tank, and then place it in an electrolytic washing tank that contains caustic and cyanide. They dip the part in a second continuous rinse tank, a second acid bath, and a final rinsing bath before plating. For plating, the parts are placed first in the nickel bath and then rinsed in a recuperative bath, dipped in a continuous rinse tank, and placed in a chrome bath.
Following chrome plating, parts are dipped in a recuperative bath and then another continuous rinse bath. Sometimes, depending on how the piece looks, workers dip the part in a second rinsing bath before placing the part on a rack for drying.

Figure 1: Overview of Facility's Electroplating Process



Economic Benefits	
Cost Saving	**US Dollars/year**
Raw material consumption reduction	**20,000**
Water consumption reduction	**2,000**
TOTAL	**22,000**
Investment	**1,500**
Payback period	**1 months**

5) Gilding: Gilding takes place in a separate room. Parts were rinsed in special rinse baths before gilding. Gilded parts are plated with nickel before gilding.

The facility faced several pollution problems including:

- polishing debris;
- use of organic solvents for degreasing;
- acid dip contamination;
- inefficient cyanide electroplating;
- unnecessary chrome and nickel waste; and
- excessive water use.

Cleaner Production Application

Cleaner production recommendations were identified for six unit operations:

- Polishing: Reduce time between buffing and cleaning; replace polishing compound with one that is compatible with aqueous alkaline cleaners; improve operator practice by purchasing fixtures and jigs; and reduce compound and wheel use through proper operator practice and training.
- Solvent degreaser: Replace this process step with alkaline cleaner.
- Alkaline cleaner: Eliminate cyanide use and improve process solution monitoring.
- Acid dip: Isolate acids for steel and brass, eliminate the process of depassivation of nickel, replace the process of mixed acid stripper with solutions in small tanks and practice segregation and recovery as well as improve process solution monitoring and control.
- Plating: Capture and return 100% of drag-out to process solutions, clean baths less frequently and improve process solution monitoring and control.
- Rinsing: Add agitation and sprays, control water use by turning off water while not used.

Enabling technologies

Most of the recommendations deal with good housekeeping practices and process control and optimization with existing technology and equipment. However, one recommendation introduces a new technology for more effective rinsing with less water. A simple sparging arrangement could be installed at the bottom of each rinse bath to disperse the incoming flow over several points and create a "rolling boil" of water which is especially effective at rinsing racked parts. Air agitation is generally even more effective, but requires a pump that can generate clean air.

Advantages

- Reduced toxic emissions and worker exposure to toxic chemicals;
- Reduced water and raw material consumption as well as process optimization;
- Reduced acid and heavy metals contaminated waste water; and
- Improved product quality.

Country

Tunisia

Industry

Electroplating

Contacts

Environmental Pollution Prevention Programme (EP3) Tunisia
75 Avenue Mohamed V
1002 Tunis - Belvedere
Tunisia

Tel: + 216 1 788244 or 786680
Fax: + 216 1 787 245
Email: Balih@EP3.TN

Eliminating Ozone Depleting Substances in the Production of Refrigerators

Background

PEG Profilo Elektrikli Gerecler Sanayii A.S. (PEG), located in Cerkezkoy, employs 3,200 people in its manufacturing plants.
The household refrigerator production factory employs 900 of these people. PEG manufactures the following:

- 24 models of household refrigerators;
- 3 models of CFC-12 compressors;
- 3 models of HFC-l34a compressors;
- 7 models of washing machines;
- 6 models of dishwashers; and
- 11 models of ovens.

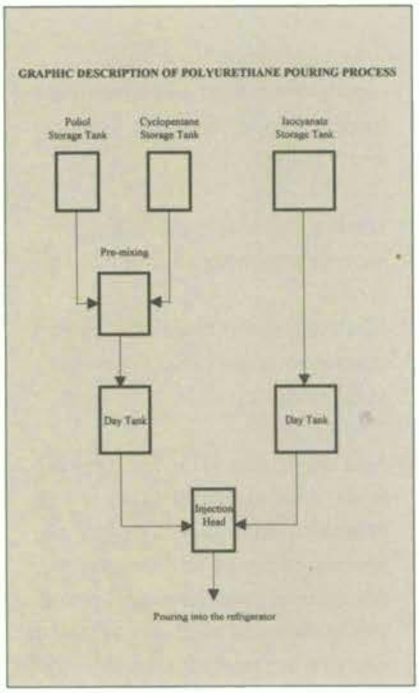
Two different types of chlorofluorocarbons (CFCs) are used in the manufacture of refrigerators. The first is CFC-11, which is used as a blowing agent in producing polyurethane insulating foam in the refrigerator. The other is CFC-12, which is used as a refrigerant in the cooling circuit of the refrigerator.

Cleaner Production Application

In compliance with the Montreal Protocol on Ozone-Depleting Substances, PEG reduced CFC-11 used in producing polyurethane insulating foam by 50% in 1992. PEG subsequently initiated a CFC Phase-out Project to implement elimination of CFCs from its refrigerators. This resulted in the establishment of the CFC Alternatives Research Commission in 1993.

The CFC Phase-out Project was composed of three phases, as follows:

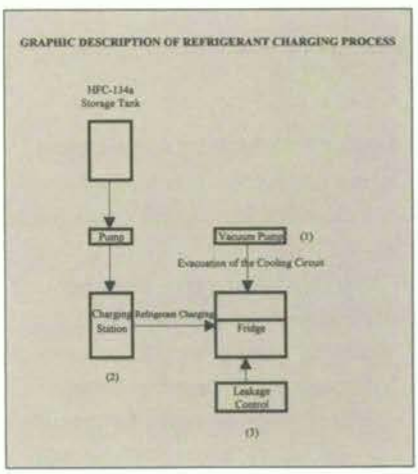
- Providing for product development using CFC-free substances, and purchase of equipment and technical support necessary for testing new CFC-free refrigerators;
- Fully eliminating the use of CFC-11 and CFC- 12 at PEG by installing new equipment necessary for commercial production of the new CFC-free refrigerators; and
- Fully eliminating the use of CFC-12 at PEG service shops throughout Turkey by installing new equipment.



The commission focused on the following substances as CFC alternatives.

- Cyclopentane replacing CFC-11 as a blowing agent in polyurethane insulating foam. Cyclopentane was selected because it has a suitable boiling point and thermal conductivity and contains no ozone depleting substances. Furthermore, cyclopentane is available at competitive prices.
- HFC-134a replacing CFC-12 as a refrigerant in refrigerator cooling circuits. HFC-134a has thermodynamic properties similar to those of CFC-1 2, and has contains no ozone depleting substances. HFC-l34a is nonflammable. HFC-134a has been accepted as an improvement over CFCs with regard to depletion of ozone.

The replacement of CFC-11 and CFC-12 by, respectively, cyclopentane and HFC-134a was undertaken. This resulted in successful development of a new line of refrigerators and compressors using the alternative refrigerant and blowing agent, in line with the project goals. This effort was supported by technical assistance for:



- Redesign of the different refrigerator and compressor models;
- Construction, prototype manufacturing, short- and long-term testing of refrigerators and compressors: and
- Training on manufacturing, maintenance and quality control of the new products.

Enabling Technologies

- Foaming system: Since cyclopentane is a flammable substances, PEG received technical assistance on the design of the cyclopentane supply system (including storage tank, piping, safety and alarm systems), supervision of installation of the cyclopentane system, and extensive safety training. The system included gas sensors, gas leakage alarms, and ventilation systems in the foaming areas. All equipment in the foaming areas were electrically grounded to prevent possible fires through static electrical discharges. An underground storage tank for cyclopentane was designed, built and installed in accordance with standard safety measures.

- Compressor system: Unlike CFC-12, HFC-134a is not compatible with mineral type oils in refrigeration compressors. Therefore a new type of oil, an ester oil, was developed by refrigeration oil producers, especially DEA Mineraloel G of Germany. The compressors were tested with the tester oil in compressor life test cells for 2,000 hours, simulating 15 years of compressor operation in a refrigeration unit. The HFC-134a refrigerator and compressor line has been in production since early 1995.

Advantages

- The replacements for CFCs result in environmental benefits with regard to elimination of ozone-depleting substances; and
- The new PEG CFC-free products will present a market advantage with the global phaseout of CFCs.

Country
Turkey

Industry
Appliance Manufacturing

Company
PEG Profilo lektrikli Gerecler Sanayii A.S.

Contacts
Mr. Kenan Bayram
Quality Assurance Department Manager
PEG Profilo lektrikli GereÁler Sanayii A.S., 59501
Cerkezkoy-Tekirdag
Turkey

Tel: + 90 282 726 73 00
Fax: + 90 282 726 53 96
Tlx: 31539 Peg Tr

Economic Benefits

Cost Saving	US Dollars/year
TOTAL	—
Investment	2,700,000
Payback period	—

N.B.: Prices of CFC alternatives are still higher than those of CFCs, so in the short-term no savings are expected.

The United Nations Environment Programme

UNEP is dedicated to bridging the gap between awareness and action. Since it was created in 1972, it has worked closely with other members of the UN network and forged new relationships among scientists and decision-makers, engineers and financiers, industrialists and environmental activists on behalf of the environment. It seeks the balance between national interests and the global good, aiming to unite nations to confront common environmental problems. Unique among UN bodies, it exists as a catalyst, spurring others to act, and works through and with other organisations, including UN agencies, industrial bodies and governments.

Industry and Environment

The Industry and Environment Office was created by UNEP in 1975 to bring together industry and governments to work in cooperation towards environmentally sound development.

The Cleaner Production Programme

This programme was launched in response to a decision from the UNEP Governing Council to reduce global pollution and waste. The objectives of the programme are to:

- increase worldwide awareness of the cleaner production concept;
- help governments and industry develop cleaner production programmes;
- foster the adoption of cleaner production throughout society; and
- facilitate the transfer of cleaner production technologies.

To meet these objectives, the programme focuses on training and the collection and dissemination of information on cleaner production that:

- explains the concept;
- illustrates technical applications; and
- helps people develop cleaner production programmes.

These efforts, initiated through a number of different activities, have cultivated an ever-expanding informal network of cleaner production experts, both in industry and government agencies. Further details are available from UNEP IE in Paris.

ECOMED

Agency for the Sustainable Development of the Mediterranean

Promoted by the Mayor of Rome with the contribution of the municipal public utilities for the environment AMA and ACEA, ECOMED is meant to act as a reference point for cooperation between the cities of the Mediterranean basin by promoting innovative environmental policies and technologies and mobilising EU and international funds.

One of the main objectives of the Agency is to promote the development of cleaner production and technologies. In particular, ECOMED encourages:

- state and private initiatives of technological and cultural cooperation oriented towards sustainable development by mobilising EC and international funds;
- coordination of institutions, associations, state and private companies based in Rome and active in the Mediterranean region;
- cooperation with the major Mediterranean cities to encourage environmentally sound initiatives;
- support to institutions and companies based in large urban areas in the South of the Mediterranean to encourage sustainable development also through the transfer of clean technologies;
- networking between teh institutions and companies in the Mediterranean urban areas on projects to be carried out with the support of the international organisations working in the region;
- relation with foreign or domestic financial operators to encourage new environmental initiatives through technical and scientific assistance to innovative projects;
- the international role of Rome's public utilities ACEA and AMA and the dissemination of environmental innovative technologies developed and experimented by them.

Ecomed

Agency for the Sustainable
Development of the Mediterranean
Via di Porta Lavernale, 26
00153 Roma
Italia

Tel: 39/6/5783564
Fax: 39/6/5781448

UNEP

Industry and Environment
39-43 quai André-Citroën
75739 Paris Cedex 15
France

Tel: +331 44371450
Fax: +331 44371474
Telex: 204 99TF
Cables: UNITERRA PARIS

IMPRESA ambiente

Editrice Il Sole 24 Ore

Redazione
Via Paolo Lomazzo, 47
20154 Milano

Tel: 02/3103245
Fax: 02/3103718

With support of the City of Rome

Cleaner production development is of vital importance to safeguard the land and the sea of the Mediterranean region.
This report, prepared by ECOMED, the Agency for the Sustainable Development of the Mediterranean, in cooperation with the United Nations Environment Programme, Industry and Environment office (UNEP IE), results from a survey conducted directly with enterprises or through specialized research institutes in the Mediterranean area on cleaner production. Cleaner production involves actions on production processes and products, aimed at reducing pollution at source and eliminating the need for traditional end-of-pipe pollution control approaches.
The report gives a summary of the present state of the art of cleaner production dissemination in Mediterranean countries through 13 case studies prepared by enterprises that achieved economic and environmental benefits by implementing cleaner production processes or technologies. The case studies were collected from Egypt, France, Greece, Italy, Malta, Spain, Tunisia and Turkey.
Even though few of the Mediterranean countries have a consistent regulatory framework to promote cleaner production, the research conducted shows that activities are increasing.