Some Examples of the Introduction of OPP

Evaporator for recycling spent cutting fluids, wash water and waste water produced by cleaning.

**Benefits**
- Elimination of splash loss, which accounted for some 70% of annual replenishment costs
- 81% reduction in water consumption
- 95% reduction in waste liquid production

Press for recycling cutting oil from filters discarded after refining operations.

Installation of sumps and centrifuges for recycling cutting oil from workpieces.

- 50% reduction in oil consumption
- Reduction of approximately 90% in waste processing costs
- 37% reduction in oil consumption
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A company which manufactures parts and components for the automobile industry installed the following equipment in its efforts to reduce its consumption of cutting fluids and the associated production of waste and waste water:

**Investment:** €82,078.9
**Annual savings:** €135,071.6
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A company producing machine-tooled parts for the automobile, eolian, electrical and tools sectors introduced a system designed to improve environmental conditions and avoid splash loss of cutting oil.

**Investment:** €11,500
**Annual savings:** €45,922
**Payback period:** 3 months

A company which produces and distributes machinery installed equipment to avoid contamination in its workspaces.

**Investment:** €13,524
**Annual savings:** €5,630
**Payback period:** 2.4 years

**Investment:** €5,500
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**CONSTRAINTS AND CONDITIONS**

Machinery has to be compatible with the alternative fluid / agent.

Detailed studies have to establish whether the technique is suited to the process. Introduction of alternative methods for ensuring heat stability and the elimination of shavings.

The spraying / injection system used must be compatible with the new process, and suitable flow regulators / air inlets must be installed.

Investment required to be included in the machinery's operational budget.

Requires purchase of necessary equipment (e.g. vibrators, centrifugal separators, compactors).

**Environnemental Action Plan**

Regional Activity Centre for Cleaner Production (RAC/CP)

París, 184, 3ª planta - 08036 Barcelona (Spain)

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http://www.cema-sa.org

This leaflet is published by the Mediterranean Action Plan’s Regional Activity Centre for Cleaner Production (RAC/CP) to present some of the opportunities for integrated pollution prevention (OPP) in the metal machining sector. Its aim is to promote the adoption by companies working in this sector of practices, techniques and technologies designed to reduce the environmental impacts of their activity.

There are two principal techniques used in the metal machining sector:

- **Plastic deformation**, where the shape of the workpiece is altered without stock removal.
- **Machine tooling**, where the workpiece is shaped via stock removal.

The environmental impact of metal machining largely derives from the use of cutting fluids in contact between tool and workpiece. These fluids are used for cooling, lubricating and removing shavings generated during tooling. Cutting fluid which has lost its efficacy is generally disposed of as liquid and solid waste.

There are plenty of opportunities in the metal machining sector for reducing the environmental impact of processes, especially where reducing and preventing contamination are concerned.

Prevention of Contamination in the Metal Machining Sector

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CONTRIBUTIONS AND BENEFITS

- Investment in equipment and installation of systems where open or semi-enclosed machinery is used.

- Installation of a pump and piping system to recirculate the fluid.
- Installation of fluid refining equipment: oil separators (e.g. skimmers), solid separators (e.g. hydrocyclones) or oil and solid separators.
- Installation of suitable equipment for purifying degreasing solutions (e.g. mechanical devices, magnetic separators, ultrafiltration of surfactant and oil absorption).
- Existing equipment has to be modified to become compatible with the new filtration system.
- Requires purchase of necessary equipment (e.g. vibrators, centrifugal separators, compacters).

- Investment in the fairing most suited to the machine characteristics.
- Replacement of furnace burners with the adoption of certain control parameters (temperature, fuel type etc.) to optimize the reduction of NOx emissions.
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- Investment in R&D.
- Investment in employee training.
- Creation of procedures, definition of responsibilities, personnel training, investment in measurement apparatus and application of corrective measures.
- Machinery has to be compatible with the alternative fluid / agent.
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## Metallurgy Sector

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<th>Basic metal industry</th>
<th>Pilot metal processing</th>
<th>Intermediate products</th>
<th>Parts finishing</th>
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### Forming
- Cold rolling
- Cold wire drawing
- Cold ribbing
- Drawing and punching
- Cold forming by folding

### Tooling
- Turning
- Milling
- Drilling
- Threading
- Drifting
- Broaching
- Grinding

### Heat Treatment
- Annealing
- Quenching
- Tempering

### Surface Treatment
- Degreasing
- Toxic gas emissions
- Machine noise

### Principal Environmental Factors
- Emission of toxic gases to the atmosphere
- Electricity consumption by machinery
- Waste: spent cutting fluid, offcuts, scrap, shavings, sludge, oil-impregnated filters
- Wastewater from plant cleaning
- Oil vapour emissions
- Power consumption by furnaces
- Spent quenching oil
- Coolant waste
- Emissions: HC, SO2, NOx, CO, CO2
- Consumption of degreasing agents
- Liquid effluents: solvents and spent degreasing agents
- COV and water vapour emissions

### Benefits
- Investment in R&D
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### Opportunities for Integrated Pollution Prevention

#### Reduced Consumption
- Creation of a control plan for the industrial hygiene point of view
- Creation of a control plan for the industrial hygiene point of view
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#### Reduced Emissions
- Creation of a control plan for the industrial hygiene point of view
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METALLURGY SECTOR

Basic metal industry
First metal processing
Intermediary products
Parts finishing

PRINCIPAL ENVIRONMENTAL FACTORS

• Dust and fume generation
• Electricity consumption by machinery
• Waste: spent cutting fluid, offcuts, scrap, shavings, sludge, oil-impregnated filters
• Wastewater from plant cleaning
• Oil vapour emissions
• Machine noise
• Power consumption by furnaces
• Spent quenching oil
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• Emissions: HC, SO2, NOx, CO, CO2
• Consumption of degreasing agents
• Liquid effluents: solvents and spent degreasing agents
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OPPORTUNITIES FOR INTEGRATED POLLUTION PREVENTION

BENEFITS

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<th>CONSTRAINTS AND CONDITIONS</th>
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<td>Formulation of a central plan for metal forming and cutting fluids</td>
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<td>• Reduced emissions</td>
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<td>Adoption of less hazardous cutting fluids and degreasing agents</td>
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<td>Dry machining</td>
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<td>Adoption of Minimum Quantity Lubrication (MQL) technology</td>
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<td>Machine fairings</td>
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<td>Reduction of annealing furnace NOx emissions via the introduction of low-NOx burners</td>
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<td>Purification and recycling of alkaline degreaser solutions</td>
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<td>Adoption of reusable filtration media</td>
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Energy

WATER

LIQUID EFFLUENTS

SOLID WASTE

ATMOSPHERIC EMISSIONS

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• Annealing
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• Degreasing
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Basic metal industry
Basic metal processing
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• Electricity consumption by machinery
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OPPORTUNITIES FOR INTEGRATED POLLUTION PREVENTION

BENEFITS

REDUCED CONSUMPTION REDUCED EMISSION

CONSTRAINTS AND CONDITIONS

REDUCED CONSUMPTION

REDUCED EMISSION

BENEFITS

INVESTMENT IN R&D.

INVESTMENT IN EMPLOYEE TRAINING.

CREATION OF PROCEDURES, DEFINITION OF RESPONSIBILITIES, PERSONNEL TRAINING, INVESTMENT IN MEASUREMENT APPARATUS AND APPLICATION OF CORRECTIVE MEASURES.

MANAGEMENT AND INTEGRATED CONTROL OF THE WORKSHOP.

APPROPRIATE PLANNING OFIVESTMENT IN THE FAIRING MOST SUITABLE TO THE MACHINE.

REPLACEMENT OF FURNACE BURNERS WITH THE ADOPTION OF SPECIFIC CONTROL PARAMETERS TO OPTIMIZE EMISSION REDUCTION.

INSTALLATION OF REGENERATIVE OR RECOVERY BURNER SYSTEMS.

INSTALLATION OF A PUMP AND PIPING SYSTEM TO RECYCLE THE LIQUID.

INSTALLATION OF FLUID-REFINING EQUIPMENT: OIL SEPARATORS (E.G. SKIMMERS), SOLID SEPARATORS (E.G. HYDROCYCLONES) OR OIL AND SOLID SEPARATORS.

INSTALLATION OF SUITABLE EQUIPMENT FOR PURIFYING DEGREASING SOLUTIONS (E.G. MECHANICAL DEVICES, MAGNETIC SEPARATORS, ULTRAFLTRATION OF SURFACTANT AND OIL ABSORPTION).

EXISTING EQUIPMENT HAS TO BE MODIFIED TO BECOME COMPATIBLE WITH THE NEW FILTRATION SYSTEM.

REQUIRES PURCHASE OF NEEDED EQUIPMENT (E.G. VIBRATORS, CENTRIFUGAL SEPARATORS, COMPACTORS).

INVESTMENT IN EQUIPMENT AND INSTALLATION OF SYSTEMS WHERE OPEN OR SEMI-ENCLOSED MACHINERY IS USED.

REQUIRES INVESTMENT AND INSTALLATION OF ADDITIONAL SOLVENTS OR SOLVENT-REPLACING MATERIALS.

REDUCED CONSUMPTION

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The environmental impact of metal machining largely derives from the use of cutting fluids in contact between tool and workpiece. These fluids are used for cooling, lubricating and removing shavings generated during tooling. Cutting fluid which has lost its efficacy is generally disposed of as liquid and solid waste.

There are plenty of opportunities in the metal machining sector for reducing the environmental impact of processes, especially where reducing and preventing contamination are concerned.

Constraints and Conditions

This bullish is published by the Mediterranean Action Plan’s Regional Activity Centre for Cleaner Production (RAC/CP) to present some of the opportunities for integrated pollution prevention (OPP) in the metal machining sector. Its aim is to promote the adoption by companies working in this sector of practices, techniques and technologies designed to reduce the environmental impacts of their activity.

There are key principal techniques used in the metal machining sector:
- Plastic deformation, where the shape of the workpiece is altered without stock removal.
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SOME EXAMPLES OF THE INTRODUCTION OF OPP

Evaporator for recycling spent cutting fluids, wash water and waste water produced by cleaning.

- Elimination of splash loss, which accounted for some 70% of annual replenishment costs
- 81% reduction in water consumption
- 95% reduction in waste liquid production

Press for recycling cutting oil from filters discarded after refining operations.

- 50% reduction in oil consumption
- Reduction of approximately 90% in waste processing costs
- 37% reduction in oil consumption
- 90% reduction in workpiece washing costs

A company which manufactures parts and components for the automobile industry installed the following equipment in its efforts to reduce its consumption of cutting fluids and the associated production of waste and waste water:

Investment: €82,078.9
Annual savings: €135,071.6
Payback period: 7 months

Investment: €11,500
Annual savings: €45,922
Payback period: 3 months

Investment: €13,524
Annual savings: €5,630
Payback period: 2.4 years

Investment: €5,500
Annual savings: €4,560
Payback period: 1.2 years

There are two principal techniques used in the metal machining sector:

- Plastic deformation, where the shape of the workpiece is altered without stock removal.
- Machine tooling, where the workpiece is shaped via stock removal.

The environmental impact of metal machining largely derives from the use of cutting fluids in contact between tool and workpiece. These fluids are used for cooling, lubricating and removing shavings generated during tooling. Cutting fluid which has lost its efficacy is generally disposed of as liquid and solid waste.

There are plenty of opportunities in the metal machining sector for reducing the environmental impact of processes, especially where reducing and preventing contamination are concerned.

CONSTRAINTS AND CONDITIONS

Investment in R&D.
Investment in employee training.
Creation of procedures, definition of responsibilities, personnel training, investment in measurement apparatus and application of corrective measures.

Machinery has to be compatible with the alternative fluid / agent.
Detailed studies have to establish whether the technique is suited to the process. Introduction of alternative methods for ensuring heat stability and the elimination of shavings.

The spraying / injection system used must be compatible with the new process, and suitable flow regulators / air inlets must be installed.

Investment in the fairing most suited to the machine characteristics.
Replacement of furnace burners with the adoption of certain control parameters (temperature, fuel type etc.) to optimize the reduction of NOx emissions.
Installation of regenerative or recovery burner systems.
Installation of a pump and piping system to recirculate the fluid.
Installation of fluid refining equipment: oil separators (e.g. skimmers), solid separators (e.g. hydrocyclones) or oil and solid separators.
Installation of suitable equipment for purifying degreasing solutions (e.g. mechanical devices, magnetic separators, ultrafiltration of surfactant and oil absorption).
Existing equipment has to be modified to become compatible with the new filtration system.
Requires purchase of necessary equipment (e.g. vibrators, centrifugal separators, compacters).

Machine tooling, where the environment is shaped via stock removal.

The environmental impact of metal machining largely derives from the use of cutting fluids in contact between tool and workpiece. Great efforts are made for cooling lubrication and removing shavings generated during tooling. Cutting fluid which has lost its efficacy is generally disposed of as liquid and solid waste.

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