



Cleaner Production Checklists

Metal Finishing Industries



**The UNEP Centre for Cleaner Production
and
The CRC for Waste Minimisation and Pollution Control, Ltd**

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CLEANER PRODUCTION

SELF ASSESSMENT GUIDE

Water Checklist

Water Use	Monthly Use	
	Quantity	Value
Water Used (water in)		
Trade Waste (water out)		
Volume		
BOD ₅ or TOC		
Suspended Solids		
Oils and grease		
Total Cost		

Water Application

Appliance	Flow rate (litres/min)	Time in Use (hours)	Daily consumption (litres/day)	Cost per month	Percent of Total	What can we do to reduce?
Domestic Use						
Rinse Baths						
Plating Bath make-up water						

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Energy Checklist

Fuels Used	Monthly Use	
	Quantity	Value
Electricity		
Gas		
Coal		
Oil		

Energy Application

Appliance	Time in use (Hours)	Daily consumption (kWh)	Cost per month	Percentage of Total	Action (eliminate, reduce, recycle)
Heaters					
Rectifiers					
Other (Pumps)					
Ovens/Furnaces					

Resource Type Product*	Raw Materials		Wastes				Total Cost (add values and costs)	Rank	
	Quantity (kg/month)	Value	Quantity (kg/month)	Lost Product Value	Treatment Cost	Disposal Cost		Cost	Toxicity
Oils and emulsions									
Aerosols									
Cleaning solutions									
Salts									
Cyanide									
Other Products									
Metal parts									
Oil filters									
Batteries									
Rags									
Paint									
Packaging									
Paper									
Cardboard									
Glass									
Plastic									
Rags									
Empty drums									
Other									

* Note that these are suggestions only - include items that are appropriate to your operation.

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Cleaner Production Options

Use this Checklist to help identify options that may be suitable to help address the key problem areas identified in the previous tables. The ideas presented range from simple and inexpensive to complex options. Each is explained further in the manual accompanying this Guide. If a specific option is not relevant to your organisation, you may be able to adapt an idea or principle. Think laterally about your operation, ask 'why' and 'what if' type questions, and you may come up with many more opportunities to profit from Cleaner Production.

<i>CP Option</i>	<i>Questions</i>	<i>Relevance (Tick One)</i>		
		Not Relevant	Current Practice	Potential Option
Housekeeping	Is the state of general housekeeping affecting the flow of work or causing spills?			
	Are stock and chemical supplies etc being stored in inappropriate places?			
	Can preventative maintenance be improved to minimise leaks, energy use etc. <ul style="list-style-type: none"> • filters • anodes / cathodes • meters • sensors • tanks and tank liners 			
	Can inventory practices be improved? <ul style="list-style-type: none"> • just-in-time purchasing practices. • control the distribution of hazardous / expensive chemicals 			
	How are spills managed? Could it be improved upon?			
	Can staff awareness about spills and housekeeping be improved?			
	Can contamination of plating solutions be reduced? <ul style="list-style-type: none"> • removing parts when they fall in the bath • keeping racks clean • filtering incoming air if air agitation is used 			
Production planning	Can the process layout be improved upon by streamlining of tank layout?			
	Would process control be improved by incorporating overhead racks?			
	Could production scheduling be improved? e.g. process all items of the one colour at the same time?			

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<i>CP Option</i>	<i>Questions</i>	<i>Relevance (Tick One)</i>		
		Not Relevant	Current Practice	Potential Option
	Are parts pre-inspected to prevent processing of rejects?			
Cleaning and Pre-treatment	Are there any opportunities to avoid the requirement to clean? Just-in-time delivery system requesting supplier to provide parts that are			
	Can physical cleaning methods be used to replace some chemical cleaning? <ul style="list-style-type: none">• wiping off grease / oil with a rag• blowing with air• blasting systems			
	Are there any solvent cleaning agents being used which could be replaced with aqueous cleaning systems?			
	Could any chemical cleaning agents (acid / caustic / solvent) be replaced with other systems such as <ul style="list-style-type: none">• detergent based aqueous cleaning (such as a parts washer)• ultrasonic cleaning			
	Could the life of cleaning solutions be extended by filtering?			
Control of bath conditions	Is there opportunity to change to a process which requires lower concentration of bath metals and chemicals?			
	Are baths being maintained at minimum chemical and metal concentrations to achieve the necessary product quality? (REMEMBER suppliers may recommend higher than necessary concentrations.) Can bath temperatures be increased without effecting product quality? (This will reduce viscosity and hence dragout)			
	Are there opportunities to reduce heat loss? <ul style="list-style-type: none">• insulation of tanks• covers on tanks when not in use• floating balls or satchels• chemical mist suppressants to reduce vapour loss			

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<i>CP Option</i>	<i>Questions</i>	<i>Relevance (Tick One)</i>		
		Not Relevant	Current Practice	Potential Option
	<p>Could the life of bath solutions be extended by:</p> <ul style="list-style-type: none"> • filtration • using deionised or distilled water • electrolytic removal of unwanted metal contaminants 			
	Is the bath solution being agitated to maximise the rate of surface application?			
Reducing Drag-out	Could you slow down withdrawal rate and increase drainage time?			
	Could parts be oriented differently on the racks to improve free draining?			
	<p>Could product modifications be suggested to suppliers to improve drainage?</p> <ul style="list-style-type: none"> • drain holes • different seams 			
	Could drain boards or drip trays be used to catch and drain solution back to the process bath?			
	Could wetting agents be used?			
	Could fog sprays or air knives be used above the plating tank to knock off or dilute drag out?			
	Is drag out collected and returned to the process?			
	<p>Could the metals and chemicals in the drag out be concentrated before returning back to the process?</p> <ul style="list-style-type: none"> • evaporation • reverse osmosis • ion exchange • electro dialysis • electrowinning 			
Rinsing Techniques	Could spray or fog tanks be incorporated in the rinsing process?			
	Are rinse tanks agitated to improve rinse efficiency? (mechanic agitation is preferable to air agitation)			
	If you have static rinses, can you increase the number of tanks to improve rinse efficiency?			
	<p>If you have running rinses, is water inflow controlled to the minimum?</p> <ul style="list-style-type: none"> • turning hoses off when not in use 			

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<i>CP Option</i>	<i>Questions</i>	<i>Relevance (Tick One)</i>		
		Not Relevant	Current Practice	Potential Option
	<ul style="list-style-type: none"> • flow restrictors • flow controllers 			
	Could you incorporate counter current rinsing to reduce water consumption?			
Alternative processes	Could you consider using alternative plating systems? <ul style="list-style-type: none"> • non-cyanide systems for zinc (acid / alkaline) • trivalent chrome instead of hexavalent chrome 			
Reuse and Recycling	Can I segregate my waste streams to allow for more effective reuse or treatment?			
	Can I reuse water from treatment plants in non-critical processes (e.g. rinses after cleaners or pickle tanks or in the hose down areas)?			
	Can any waste heat be used elsewhere?			
Treatment and Disposal	Could the following technologies be considered to reclaim metals and chemicals from the wastewater? <ul style="list-style-type: none"> • precipitation • ion exchange • electrowinning • reverse osmosis • electro dialysis 			
Management & Training	Does management support the program for Cleaner Production?			
	Are the procedures for waste minimisation well known, supported and widely practised throughout the organisation?			
	Has training been provided to raise staff awareness about Cleaner Production and to provide the skills necessary to develop and implement a successful plan?			
	Do staff know what to do with each type of waste? <ul style="list-style-type: none"> • training in correct procedures. • laminated signs posted around the site. 			
	Are employees fully involved in the suggestion and improvement process?			
	Can you use your waste reduction programs and achievements as a marketing tool?			

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Evaluation of Cleaner Production Options

To determine which options are the best for your organisation you will need consider a range of financial and non-financial considerations associated with each.

Financial Considerations

To help determine the company's financial ability to implement each option and its economic viability. Once you have a short list of possible option you can use the following table to evaluate them.

Consider:

- the cost and benefits of each option
- the capital investment required; and
- the payback period.

CP Option	Example	Value		
		1) (e.g. Install Static Tank)	2) (e.g. install Flow Restrictors)	3)
Capital Costs	Equipment			
	Installation			
Annual Costs	Maintenance			
	Materials			
Total Costs				
Benefits	Increased Sales			
	Sale of By-products			
	Annual Savings:			
	Materials			
	Water			
	Energy			
	Treatment			
	Disposal			
Total Benefits				
Net Annual Benefits				

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Payback Period				
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Other Considerations

As well as financial options, you also need to consider how the change will impact on your other systems and the practical implementation issues associated with each option.

Non-Economic Analysis		
Questions	Notes (sources, causes, potential improvements)	Likely Impact (1-5)
How will the change affect product quality (positive/negative)? Are any trade-offs acceptable? How will the change affect health and safety (positive/negative)?		
What are your customers expectations? Would they care about the change? What changes would they accept or even find desirable?		
What impact will the change have on the environmental performance of the company (i.e. reduce the toxicity or impact of wastes, reduce environmental liability etc.)?		
What are the requirements of people in different departments (i.e. purchasing, cleaning, production, maintenance)? What is the best compromise solution?		
How easy will it be to implement the change? How much time, and expertise will be needed? Are these resources readily available?		

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