Waste Minimisation at an Electroplating Company (MF22)
Case Study 1
Metal Finishing Waste Minimisation Club

Background

MF22 is a small electroplating job shop situated in Seaview, Durban, South Africa. It was established in 1981 and employs 50 staff members. Articles are brought to the factory for plating or polishing by the customer. In general the customers are either not big enough to run their own plating section or the objects to be plated are difficult to handle. Many changes have been made to the factory over the years in order to maintain a leading position among the competing companies in the area. New sections have been added and the design of the existing sections changes regularly to meet the needs of the customer.

The Process

A large number of different processes are carried out in the factory. These include: zinc electro-galvanising; nickel plating; chrome plating; copper plating; cadmium plating (minimal); silver plating; gold plating; irridising; anodising; tin plating; and brass plating. Base metals include Steel, copper, brass, dicast alloy and aluminum. Both line (jig) and barrel plating takes place.

Objects plated include screwdrivers, electrical components, fences stove parts, screws and paraffin lamps and exhaust pipes etc. The factory must therefore be flexible in its process to accommodate these varying plating requirements.

Identification of Waste Minimisation Options

Prior to implementing a waste minimisation programme, the company had one water meter, which was recorded monthly by the local authorities, and there was limited control over water, chemical and energy use in the factory. Effluent discharge was a major concern to the company due to the implementation of new bylaws for discharge of industrial effluents to sewer. This was the main motivating factor for investigating reduction of waste at source.

A total of 25 waste minimisation options have been identified for the site. These are listed in Table 1. The majority were identified by the company themselves, with assistance from students.

Implementation of Waste Minimisation

Of the options identified, 23 have been implemented. The owner of the company was initially skeptical of the benefits of waste minimisation, but has since proved to himself and others that waste minimisation results in both financial and environmental savings.

Table 1: Summary of Identified Waste Minimisation Options

Waste Minimisation Option	Status
1. Install drag-out tanks	Implemented
2. Reduce rinse water flow	Implemented
3. Change to counter flow rinsing	Implemented
4. Fix all leaks	Implemented
5. Close municipal tap at end of Zn line and use borehole water	unknown
6. Shut - off taps permanently that are not in use	Implemented
7. Monitor water use daily	Implemented
8. Install more water meters on incoming water	Implemented
9. Employ chemical storeman to control chemical use	Implemented
10. Install automatic crane over Cr bath to increase drip times	Implemented
11. Increase drip times over all baths	Implemented
11. Eliminate the use of cyanide	Implemented
12. Reschedule oven use to reduce heating costs	Implemented
13. Reuse Electro cleaner	Implemented
14. Slow down cranes on Zn line to reduce carry over	Implemented
15. Skim oil off Electro cleaner to prevent contamination	Implemented
16. Undertake staff training	Implemented
17. Rebuild floors	ongoing
18. Optimise hanging articles on the jig to improve drainage	Implemented
19. Redesign stoppers on screwdriver plant	unknown
20. Install effluent treatment plant to reduce SS	Implemented
21. Switch off rectifiers overnight	Implemented
22. Educate customers to use less harmful metals	Implemented
23. Improve insulation on all heated tanks	Implemented
24. Install thermostats to ensure tanks operate at optimum temperature	Implemented
25. Reuse rinse water in the trichloroethylene tank	Implemented

The areas chosen for investigation for improvement included:

- Water consumption (overall and in each department),
- Chemical control,
- Reducing metal concentrations to drain,
- Energy use, and
- Effluent control.

Water consumption:

The company now has 8 water meters, which are read on a daily basis, resulting in the identification of any problems as soon as they occur. Both municipal and borehole water are used in the factory, both of which are monitored. Water flows in all rinse tanks were adjusted to the minimum and unnecessary taps shut-off. Additional drag-out tanks were installed and rinse waters reused where possible. Counter-flow rinsing was installed where ever feasible. Targets for water use in each department were set and monitored on a weekly basis. This has resulted in a 70% reduction in municipal water use (from 2 700 kl / month to 800 kl / month), and a 50% (4000 kl / month to 2000 kl / month) reduction in borehole water use. There is a corresponding decrease in the volume of effluent discharged to drain.

Chemical control:

A storeman was employed to ensure that chemicals were used only when necessary resulting in baths being used to their full potential rather than being topped up or remade at random intervals. Installation of drag-out tanks, increasing drip times and reusing chemical baths has

also resulted in less chemicals being wasted. These measures have shown an overall reduction in chemical costs (excluding metals) of between 10 and 15%.

Reducing metal concentrations to drain:

By installing an automatic crane above the chrome plating tank (see diagram on right), the articles are lifted out the tank at a controlled rate and allowed to drip-off over the plating bath for a longer period of time. This has resulted in less drag-out of the chrome salt and therefore less metals being discharged to drain. 25 kg of chrome is saved per month and a corresponding decrease in sodium meta bilsulphite has been achieved due to a reduced treatment requirement.

Replacement of the zinc cyanide plating process by the zinc alkaline process (see diagram on left) has decreased the concentration of zinc being discharged to drain and eliminates the need for cyanide. This has not resulted in a cost saving to the company, but has other benefits such as:

- Reduced metals to drain
- Eliminated the health risks of storing and using cyanide
- Eliminated the need to treat the effluent for cyanide

In addition, the company has managed to convince a customer to accept an alternative finish to cadmium plating. This has resulted in the use of the cadmium plating line being decreased from one day per week to the occasional job.

Energy use:

The company has embarked on an energy survey to identify all areas where heat is used in the factory. By rescheduling the drying of articles, an oven is now used only 3 hours per day, where previously it was left operating for 8 hours a day. Switching off rectifiers overnight has also resulted in energy savings. Insulation on heated tanks has been improved and thermostats installed to ensure that tanks operate at the minimum required temperature. An overall saving of 12% on the electricity bill has been achieved.

Effluent control:

An effluent treatment plant has been installed on site to ensure compliance with the new regulations for discharge to sewer. A filter press has been commissioned to remove the sludge and this is disposed of to landfill. While it is recognised that this is an end-of-pipe solution, it is important to note that by reducing waste in-house, the plant could be sized correctly and less treatment chemicals are required than previously.

Economic Benefits

Item	Saving (Approximate Rands / annum)	Pay-back
Water	60 400	Immediate
Chemicals and Metals	68 400	Immediate
Electricity	33 000	Immediate
Effluent charges	33 800	Immediate
TOTAL	**195 600**	

Environmental Benefits

- A reduction in Zinc metal to drain from 50 to 60 ppm to less than 25 ppm
- Eliminating the need for cyanide and therefore the related health hazards
- A reduction in the use of cadmium and therefore a decrease in its discharge to the environment
- A reduction of 275 kg / year of Chrome being discharged to drain
- A 70% reduction in water use from municipal sources
- A 50 % reduction in the use of river water (borehole)
- A reduction in the volume of effluent discharged to sewer
- A reduction in the use of electricity

Note:

This company has adopted a programme of on-going improvement and therefore changes are being made on a regular basis. This case study information summarises those results achieved from June 1998 to August 2000.

Contact Details

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