

HEALTH & SAFETY IN METAL FINISHING

*A discussion on new product development
and the DANIDA-SAMFA partnership*

There are many businesses where it is relatively easy to maintain a safe and healthy environment for employees. Much of the retail industry would fall into this category. Stationery stores, clothing stores, travel agencies, accounting practices, estate agencies – there are hundreds of examples of businesses that are clean and don't present many threats to the health and safety of their workers.

The metal finishing industry is unfortunately one of those where hazards and risks abound. Electroplating is singled out as one of the most dangerous environments due to the use of a large inventory of toxic chemicals and solutions in combination with a lot of electrical apparatus. Traditionally, electroplaters also generate large volumes of toxic effluent. However, hot dip galvanizing, anodizing, powder coating, metal spraying and the like all present significant health and safety hazards.

Is the industry attempting to put its house in order? The short answer is yes, massive efforts have been made. The purpose of this article is to highlight the steps that this sector has taken internationally and locally to lower negative environmental impact and improve the working environment in terms of health and safety.

The thrust has been on two fronts. On the one hand there has been a drive to develop coating systems that rely on more environmentally friendly chemicals and on the other there has been concerted scientific evaluation of process lines that has resulted in significant modifications to layout and handling methods. Operators that have elected to alter their lines to meet modern standards have shown massive savings in raw materials and water and a corresponding drop in effluent generation and treatment costs.

A natural corollary of this has been an improvement in working environments from a health and safety perspective.

DEVELOPMENTS IN BATH CHEMISTRY

The most significant changes in the chemistry of solutions relate to the use of hexavalent chromium compounds, cyanide compounds and cadmium metal

with its compounds.

Hexavalent chromium has been banned for use in zinc chromate conversion coatings in the motor industry and new maximum exposure limits for hexavalent chromium in the plating shop have been introduced. The chemical is a known carcinogen and has a heavy negative impact in sewerage treatment systems where it interferes with or totally stops the biological breakdown processes utilised.

Cyanide, traditionally used in many plating process is highly toxic by ingestion, skin absorption and inhalation as a dust or a gas that forms in combination with the acids that are freely used in plating shops.

Work has also been done on finding alternatives to cadmium. This metal which has many excellent properties is most dangerous as a dust or fume generated through grinding and welding operations. Use in metal fabrication and on machine components is being severely restricted. It is known that with exposure to cadmium there is potential for harm to the kidneys and lungs and evidence that it is a carcinogen. In the plating shop it can enter the system through the inhalation of mists above the plating tank.

In response to these known issues, the industry has developed the following new products:

- ♥ Decorative chrome plating solutions based on trivalent chrome compounds.
- ♥ Chromate conversion coatings, also referred to as passivates based on trivalent chrome compounds for use on zinc plated finishes.
- ♥ Alkaline non-cyanide zinc plating solutions that have advantages over acid based zinc systems in some applications.
- ♥ In addition there has been very productive research conducted into zinc alloy systems that has given us new zinc-nickel, zinc-cobalt, zinc-iron and zinc-tin systems that offer dramatically improved service life in specific environments and that are able to replace cadmium in most applications.
- ♥ Cyanide-free copper, brass and silver plating solutions have been

brought to the market but there has been limited uptake of these offerings due to technical and pricing issues.

- ♥ Electrophoresis or e-coating is an area that has seen strong development, mainly because the process chemicals used are generally less hazardous. Today there are several finishes like simulated gold that compete head on with traditional electroplated finishes.

CLEANER PRODUCTION TECHNIQUES

Cleaner Production, Resource Conservation, P2 [Pollution Prevention] Waste Minimisation; these are all terms that describe industry programs implemented to reduce the negative environmental impact of operations whilst simultaneously lowering operating costs and improving profits. Such strategies have been proven to be particularly effective in the electroplating and allied fields.

Operators may have to rely on the large supply houses to develop safer chemical systems but they are very much empowered to make changes in layout of their plating lines and in the techniques used in production.

Cleaner Production [CP] programs are well researched and are in place in all the developed industrial countries. South Africans have been fortunate to have had assistance from DANIDA, the Danish Foreign Aid agency, with the implementation of our own CP program. The original initiative, the CPMFI project [Cleaner Production in the Metal Finishing Industry] ran for a period of three and a half years, officially ending in 2004 and culminating in the establishment of SAMFA, the South African Metal Finishing Association. Thanks to contributions of finance and technology transfers from Denmark over this period, the foundations of improved structures were put in place for our local industry.

CPMFI PROJECT OUTCOMES

There were many positive outcomes. During the project period three study tours to Denmark were arranged. In all forty six representatives from various sectors of the metal finishing industry participated and were able to learn first hand about international best practice.

Various types of environmental assessments were performed in participating South African enterprises. Fifty walk-through type evaluations were done where trained consultants noted improvements that could be put into practice and reported on them. More detailed environmental audits along with feasibility

studies on implementation of improved technologies were performed in twenty six companies. Ultimately eighteen of these went ahead and implemented the technology with partial subsidies from DANIDA totalling 1.2 million Rands. These companies achieved combined savings of around 3.8 million Rands in year one and on average recouped their investments through savings in an average period of 18 months.

During this time training materials were produced for the Hot Dip Galvanizing Association of South Africa [HDGASA] as well as for SAMFA. To date SAMFA has put well over 200 trainees through its supervisor training course for electroplaters. Whilst the course primarily teaches plating technology, it centres on CP techniques in achieving good plating results. DVDs that simplify the concepts have also been produced.

DANIDA OHS PROGRAM FOR THE METAL FINISHING INDUSTRY

Thanks to the unqualified success of the original project, the Danish decided to make funds available to launch a second related initiative.

Health and Safety concerns and Environmental concerns are closely linked. The health and safety of workers inside offending factories is threatened by haphazard management of chemicals and chemical processes that also has a spill over effect on the environment. The health and safety of entire communities is threatened by industrial pollution which is an environmental issue. In the course of the original CP project many OHS issues surfaced so it seemed natural to launch an "OHS in the Metal Finishing Industry" project as a follow-on exercise. This resulted in another group of South Africans visiting Denmark on a fact-finding tour during October 2005 with the new project being launched in 2006.



**It's about owners
and managers being
able to sleep easily
at night**

When boiled down to its essence, good Health and Safety practice in the workplace is all about owners and managers being able to sleep easily at night. Perhaps, more importantly, it's about concern for one's fellow man. There are few belief systems on earth that don't propound, as a central tenet, the compassionate treatment of one's fellow man. The principle of doing unto others as you would have them do unto you is universally accepted

There should be no need for any further motivation but this noble sentiment is often supported only by lip-service. Many people who ordinarily exhibit kind and compassionate social behaviour seem unable to fully project these attributes into the workplace scenario. There exists a type of passive resistance to accepting the possibility of long term health problems for employees being exposed regularly to known hazards. Similar reactions pertain to environmental damage from effluents and emissions. The strengthening possibility of being held financially responsible in the distant future is not being faced. It is a universal problem. One only has to consider much of the industrialised world's slow response to scientists' dire warnings on global warming to deduce that concern for one's fellow man is not in abundant evidence.

This is a fundamental motivation for maintaining a strong industry association that acts as the conscience of an industry whilst assisting with practical implementation of industry improvement programs.

In the case of the new Health & Safety projects, SAMFA has developed an intervention which ties the concept of house keeping to health and safety. It is styled as the "Seven-Minute-Plan" because it seeks to reinforce the notion that ongoing small daily efforts to put things right are likely to be more successful than a large fix-it-all blitz approach. The Seven-Minute-Plan stands a better chance of adoption because blitz approaches are likely to be delayed due to budget constraints, production demands and the like.



A SAMFA Seven-Minute-Plan manual has been introduced. The manual is probably one of the most useful documents every produced for the industry. Written in easily understandable language, it combines in its 70 pages a distillation of all applicable health and safety legislation in

South Africa together with guidelines for risk assessment and a self-help house-keeping improvement section. Check lists and charts to assist with implementation are included in the appendices.

Thanks to DANIDA funding, sponsored consultancy was offered to a limited number of companies that elected to implement the 7 minute plan. Eight

companies around South Africa took up the offer. Consultants visited these operations, took photographs of areas of concern and then submitted a report with recommendations for improvements. The participants then set a time frame to achieve the improvements at which time the consultants return to take the “after” pictures. The success stories will be featured in our publications with the top performers receiving special recognition at an awards ceremony that will be held at the SAMFA trade expo planned for Thursday 10th July 2008 in Johannesburg.

The emphasis on health and safety has been reinforced in all of SAMFA'S training programs. The newest of these, Tank Hand Safety in the Metal



Finishing Industry, is aimed specifically at the workers closest to risky situations and was very successfully launched during 2007 with presentations in our three major regions, Gauteng, KwaZulu Natal and the Cape.

In summary, there have been strides at all levels over the past few years to make the necessary changes so that the metal finishing industry can stand tall and proud. The technology is there to enable the use of safer chemicals and safer operating systems. It is up to individual businesses to commit themselves to making these improvements.

Clients of the metal finishing industry also have a large influence on how the industry behaves on environmental and health and safety issues. Just as the automotive industry was the driving force to restrict the use of hexavalent chromium, so each individual user of metal finishing services may elect to withdraw support from “messers” that regard the health and safety of their workers and the condition of our environment as secondary to the accumulation of profit.

There is no excuse today to behave irresponsibly. The chemical products are there, cleaner production technology is freely available and SAMFA is on hand to dispense advice and assistance to any operator that wants to commit to building a better working environment and ultimately a better world for us all. 