ISO 14001 Environmental Management Systems (EMS) for the Electroplating Industry

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On September 26, 1999 both the Ford Motor Company and General Motors issued press releases requiring all suppliers to obtain ISO 14001 Certification. This action was based largely on two factors. First, these firms are finding that ISO 14001 Certification is necessary to market products internationally. Second, there is genuine competition amongst these firms to have their customer's perceive their products as environmentally "green." In addition to the automotive industry, the aerospace and computer industries (IBM, Xerox) are also embracing the concepts of the ISO 14001 Standard. Finally, even President Clinton, in drafting an executive order that all federal agencies will have an EMS, has indirectly raised the question if one day the US Government might require their suppliers to have an EMS.

Historically, environmental disasters (Bhopal India, Love Canal, Chernoble) led to increased government regulations. At international trade meetings, the environmental regulatory playing field seemed unbalanced and raised the issue of trade restrictions and tariffs for goods manufactured in countries with little regard for environmental emissions and byproducts. The ISO 14001 Standard was looked to as a means of leveling the playing field.   The Standard not only requires organizations to be in compliance with regulations, but also requires that they continuously improve their overall environmental performance.

The ISO 14001 Standard lists some 52 requirements for an EMS.   The EMS follows a "plan-do-check-act" scheme found in quality (ISO 9000) and other management systems. As the requirement for an EMS filters down the supply chain, it will become more and more difficult for firms to justify the expense. Fortunately, the electroplating industry has done much with regards to pollution prevention and waste minimization. So we need not 'reinvent the wheel" as much as "document what we have already agreed to do."   In this manner we can take full advantage of our knowledge of plating solutions, disposal options, and environmental impacts.

An EMS prototype, specific to the electroplating industry, will be presented. Our intent will be to offer a cost-effective option where a return on a company's investment for an EMS is justified in an enhanced public image, a maintained market share in EMS sensitive industries, reduced risks and liabilities associated with environmental emissions and savings in energy and water management.

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Introduction

You need only to watch the nightly news to realize industry is moving toward a global marketplace.

Proponents of economic expansion site trade barriers and tariffs as inhibitors of market and economic globalization. Yet, tariffs have been proposed on goods produced in countries where compliance with environmental laws are not as strict or costly as in heavily regulated industrialized nations.

In industrialized nations there is also a trend to reduce the size of government and balance national budgets. Industries themselves hope their taking a proactive approach to environmental stewardship, will stem the perceived need to pass new regulations.

Enter the ISO 14001 Standard for Environmental Management Systems (EMS). Proponents of the ISO Standard argue that a proactive EMS, focused on continuous improvement of a company's environmental performance, might offer an acceptable alternative to the creation of additional regulations.

These and other considerations have led a number of major U.S. firms to not only seek ISO 14001 Certification, but require their suppliers to do so as well. A number of these companies look to take a leadership role in stewardship. If you are an industry leader, how better to have others to follow your lead then to ask those you do business with to adopt a similar philosophy.

In the public sector, a draft Executive Order released by the White House requests all federal agencies to curtail use of certain highly toxic chemicals and to establish an Environmental Management System. The EPA is designated as the lead agency in implementing the Executive Order. One might speculate as to whether government suppliers may one day also be asked to establish an EMS.
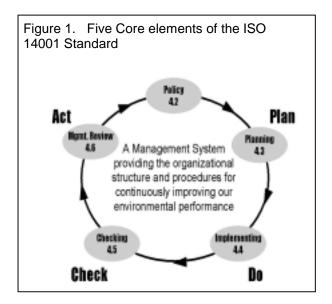
EMS Overview

Those in the electroplating and metal finishing industry may be asked by their customers to implement an ISO 14001 (EMS) system. Others may decide to implement an EMS as a means of demonstrating their commitment to environmental responsibility. There have been previous efforts to develop guidance documents for EMS implementation by metal finishing companies. Two known documents are "Environmental Management Systems: A Guide for Metal Finishers" and "Environmental Management Systems Template for Metal Finishers". Based on experience at guiding over 70 facilities through the ISO 14001 Certification process, this article supplements the previous efforts and provides several enhancements resulting in a reduction in implementation costs and the option to integrate technological advances.

An overview of an EMS system is presented in advance of discussions on the lessons learned to date.

The EMS described in the ISO 14001 Standard follows a Plan-Do-Check-Act structure.

Figure 1. Five Core elements of the ISO 14001 Standard

The ISO 14001 requires a company perform a systematic analysis of their operations to identify legal responsibilities and those aspects (e.g. metal containing wastewater discharge) of your business that have the potential to impact (e.g. adverse human or ecological effects) on the environment. If these impacts are judged by the company to be important, an operational control (e.g. wastewater treatment, rinse water recycling) will need to be established to minimize the likelihood of the impact occurring. The company will also have the option to develop environmental objectives (e.g. reduced metal content in the contaminated wastewater)

and programs. Environmental programs include the plan or task the company intends to undertake that will lead to their achieving selected objectives.

To determine if a company is actually controlling their processes and proceeding as intended with their objectives, they will need to measure and monitor some key characteristic that reflects the process (e.g. measuring chromium air emissions). In this way the company begins to gather the evidence needed to demonstrate that they are continually improving their environmental performance. (Note: the ISO 14001 Standard does not specify how much one needs to improve, but does specify that a company be able to show continuous improvement in their environmental performance.)

Supporting these efforts are requirements for training, document control, communication, internal auditing, and management review.

Benefits

Historically, the force behind a company implementing an EMS was largely attributed to the need to demonstrate environmental awareness via pollution prevention and resource conservation programs.

Although we have observed some cost reductions due to process improvements and lowered environmental costs, incidences have been sporadic and have occurred largely when employees have actually looked for cost saving opportunities.

One of the important lessons learned from our experience has been to align the EMS implementation with the company's business goals. If those business goals include the reduction of environmental costs, the EMS implementation process can accommodate that goal. By including cost data in the aspect identification and significance determination process one can develop objectives and programs based on cost reduction.

Other reasons companies are establishing EMS systems, include:

➢ Industries and industrial sectors perceived as being proactive in managing their waste emissions as well as their energy and material uses are finding that federal regulators and policy makers are more receptive to input on forthcoming legislation.

➢ Companies with international markets are finding that certain foreign countries, particularly Europe, Asia and developing countries, are requesting ISO 14001 Certification. We find this particularly true in the automotive, aerospace, and consumer goods (e.g. appliances, farm equipment, computers, electronics) industries. A trickling down of these requirements to the supplier community (greening the supplier chain) is expected to grow.

➢ Industries whose processes are associated with significant environmental risks (e.g wastewater discharges, air emissions, bulk storage of hazardous materials) may find that a proactive EMS may enhance their public image. CEO's or public relations personnel confronted with questions from the news media or public can respond by citing the proactive nature of their EMS.

➢ Organizations concerned with their own ability to stay in environmental compliance can find that the employee awareness and auditing features of an EMS will improve compliance. In addition, opinions expressed by the justice system have indicated their favorable view of an organization's EMS system when determining non compliance penalties.

➢ Although a reduction in regulatory obligations has been slow in coming, several states (Pennsylvania, Wisconsin, California, Michigan, Indiana, New Hampshire, North Carolina, Vermont, Oregon and Arizona) are providing some incentives. In contrast, it is believed by some that those industries that do not proactively control their operations will become a likely target for future, more restrictive regulations.

Costs

Starting from Ground Zero

The first automotive and aerospace companies seeking ISO 14001 Certification incurred internal costs of $150,000 to $250,000. These costs are attributed to relatively large and complex

facilities that in many ways were setting precedence and leading the way. Today, similar facilities are finding that they can often draw on the examples and lessons learned from others to reduce their EMS implementation costs. This is being accomplished largely through better organization and utilization of project management and computer-based technology.

Today, small and mid-size companies that embark on their own initiative to implement an EMS are likely to consider the costs exorbitant. This is particularly true if they have to "reinvent the wheel", not being able to take advantage of the lessons learned from their peers. National associations can help immensely by providing leadership and direction.

EMS Prototype for the Metal Finishing Industry: Charting an Approach

Integrating our EMS experience with our long-standing involvement with pollution prevention initiatives within the metal finishing industry has resulted in an industry-specific EMS prototype.

The prototype builds on the information referred to in the two earlier efforts, but focuses more on EMS development around the commonality of certain processes to the industry (Figure 2). The prototype would consist not only of template procedures and forms for collecting required data, but even more importantly provides completed examples to speed the learning process. In addition, the prototype allows companies to "jump-start" the implementation process, largely through better alignment of the EMS with the company's business operations, and by showing company's how to "get credit for already existing environmental programs.

Figure 2. Metal Finishing: Common Processes

➢ Powder Coating
➢ Painting
➢ Plating (Alkaline, non-cyanide, cyanide, acid, electroless)
➢ Parts Cleaning (Aqueous and Solvent-based)
➢ Stripping (Aqueous and Blasting)
➢ Conversion Coating (Phosphate, Chromate)
➢ Heat Treatment
➢ Passivation
➢ Electro-polishing

Computerized-based Technology

Our experience suggests that before jumping into computerization, a paper-based EMS system is prudent. Yet, for those companies currently having internet/intranet capabilities, there are a number of cost saving EMS implementation options that could be adopted early-on (Figure 3). One feature, a simple document control system, can yield significant cost savings by minimizing the costs associated with document duplication and distribution alone, particularly with multi-facility companies.

Figure 3. Computer-based Technology Options

➢ Document Control System
➢ On-line Environmental Training
➢ Training Notification System
➢ Tracking of Staff Commitments
➢ Bulletin Board & News Event Posting
➢ Environmental Data Collecting & Trending
➢ Worldwide Facilities Communications

Flexibility to Align with Business Goals.

The EMS implementation prototype is sufficiently flexible so that member companies can customize the EMS system to fit their business goals and corporate values.

The implementing company needs to determine what they want to achieve with the EMS. Our experience has shown that although the prototype needs to be flexible in many ways, it must allow for the most common requests encountered, including:

➢ Obtain ISO 14001 Certification in the most cost and time efficient manner. This option is typically chosen by those organizations that need to have an EMS to pursue a certain market.

➢ Implement the EMS in such a fashion as to demonstrate cost savings. Companies that must show a return on their investments choose this option.

➢ Implement the EMS in such a way as to focus on reducing our environmental risks and liabilities. Companies wanting to

enhance their public image, address rising insurance rates, or demonstrate a strong environmental stewardship tend to choose this option.

Each of these options is addressed in the prototype by offering alternative options for aspect identification, significance determination and setting of objectives.

Avoid the Mistakes of Others

The prototype outlines the importance of management's commitment. This commitment is necessary for EMS implementers to gain the necessary acceptance and commitments from across department lines. This commitment must be obtained with top management's full understanding of the effort and expenses involved.

The prototype stresses the importance of employees taking "ownership" by detailing when employee involvement is crucial and when it is not. Although there may be a proper time to use consultants, no EMS is worth the paper it is written on without employee ownership. Ownership will not be possible if employees feel that others made the important decisions.

The prototype must maximize the return on the required employee training by making use of examples relevant to the metal finishing industry. Using examples from other industries results in missed opportunities to make a real difference in job performance.

Finally, do not lose valuable time when performing significance determinations. The prototype provides specific enough information to allow company personnel to reasonably assess the risks and rank those risks in a relative manner.

Don't Reinvent the Wheel

The EMS Prototype takes advantage of the wide variety of systems already present at the company.

Staff of companies having ISO 9000 systems need to be shown how to take advantage of existing document control systems and the skills and training of the quality auditors. EMS Training is more meaningful if one builds on the

common elements already grasped by staffs at ISO (QS) 9000 facilities. Finally, integration of the two systems should be considered whenever cost savings are involved.

The prototype can show member companies how to "get credit" for already existing environmental programs. By existing programs we refer to not only those nationally recognized (Figure 4), but any independent initiatives that may have been undertaken by the company currently or in the past.

Figure 4. National Pollution Prevention Programs relevant to the Metal Finishing Industry:

➢ Strategic Goals Program
➢ EPA's 33/50 Program
➢ The American Electroplating and Surface Finishers Pollution Prevention Education Course
➢ The National Associations of Metal Finishers Pollution Prevention Source Book
➢ EPA's Green Lights Program

Finally, companies that choose to integrate EMS implementation with Health and Safety need information on the best means to avoid potential conflicts with Occupational Health and Safety (OSHA) regulations. Merely recognizing the most common risks confronting workers (Figure 5) in the metal industry can lead to a cost-effective integrated system focusing the companies valuable resources on the greatest risks first.

Figure 5. Most common Health and Safety issues associated with the metal finishing industry.

➢ Communication of Chemical Hazards
➢ Respiratory Protection
➢ Noise
➢ Electrical Safety
➢ Lockout/Tagout
➢ Proper Personal Protective Equipment
➢ Heavy Metal Exposure

EMS Prototype for the Metal Finishing Industry: Core Elements

EMS Policy:

The EMS policy statement is written by Top Management and "drives" the entire EMS. The Policy commits the company to regulatory compliance. The policy also commits the company to providing the framework for setting environmental objectives by which the company can continually improve its environmental performance.

Legal and Other Requirements.

The company must identify its legal and other responsibilities. Figure 6 provides a short regulatory overview of the metal finishing industry. It is equally as important to realize that should the company openly support other initiatives (e.g. Strategic Goals Program, EPA 33/50 Program) that under the ISO 14001 Standard they may be audited for conformance to those programs. It is therefore both important and beneficial to align objectives and targets of these initiatives with the objectives and targets of the EMS.

Figure 6 Typical Legal Requirements of the Metal Finishing Industry.

➢ Clean Water Act (40 CFR Sections 433,413)
➢ Clean Air Act (degreasing operations, coating emissions, and chromium emissions
➢ Resource Conservation and Recovery Act (regarding storage, handling, manifesting, and reporting of hazardous wastes)
➢ Superfund SARA Form R Reporting Requirements.

Aspect Identification

Aspect Identification refers to the systematic analysis of a company's activities, products, and services that can potentially impact the environment. This includes not only the generation of waste by-products and utilization of natural resources, but includes nuisance conditions (odor, noise) that may impact the surrounding community. Our experience has shown that this effort can be reduced dramatically, if proper guidance specific to the

industry is provided in the prototype. Information regarding the typical aspects associated with the common processes (Figure 7 is an example for parts cleaning), and guidance on what information needs to be collected to support the Significance Determination.

Figure 7. Parts Cleaning: Aspect Identification

Inputs:
➢ Chemical Cleaners
➢ Steam
➢ Electricity
➢ Water

Outputs:
➢ Wastewater contaminated with oils, cleaning chemicals, metals, carbonates, hydroxides
➢ Air Emissions of fugitive volatile organic hydrocarbons, and mists
➢ Solid/Liquid wastes as in sludges, and contaminated filters.

Significance Determination

The process of Significance Determination is intended to prioritize those aspects of an company's business that have the potential for the greatest impact on the environment. This is also intended to focus the company's valuable resources on the highest priority needs. The ISO 14001 Standard, however, provides no details on how to judge significance. Perhaps this is by design. As hinted earlier, the Standard expects a company to align its EMS with its business goals. The EMS prototype for Metal Finishing provides a number of options for evaluating significance. Options that reflect a company's business goals, including: regulatory compliance, cost reduction, protection of workers, and/or reducing the real risks associated with chemical handling or management.

Operational Controls

The purpose of the Significance Determination is to identify the company's Significant Aspects (i.e. those aspects of the business that can

cause a significant change in the environment.) Each Significant Aspect must have an Operational Control. An Operational Control is a device, work instruction, sign, or alarm that is intended to prevent or minimize the impact from occurring. When common industrial processes are involved, the prototype should identify benchmark operational controls used by the industry (e.g. dragout, spray rinsing, chemical addition metering) along with non-industry specific controls (work instructions, signs, etc.)

Objectives, Targets, Programs

Objectives and Targets are set by the company to continually improve its environmental performance. A significant portion of the metal finishing industry subscribes to the Strategic Goals Program and prior to that the EPA 33/50 Program. The EMS prototype, therefore, needs to recognize the option to integrate these objectives into the EMS. The prototype should also convey the latest in process-specific knowledge regarding pollution prevention, energy conservation, alternative material use, and waste minimization so that a company's objectives can be based on realistic expectations.

Environmental Programs are the action plans the company intends to follow in pursuit of meeting its objectives. The Program lists the specific steps to be followed. For example, in considering the pollution prevention work already performed by the AESF and NAMF, it is possible that one of the first steps would include the review of pollution prevention information provided by these organizations.

Measuring and Monitoring

The EMS must include the means of measuring and monitoring key characteristics associated with operational controls and the company's objectives. This will allow the company to determine if it is adequately controlling its processes and if the objectives set around its significant aspects are indeed moving in the intended direction.

Measuring and monitoring techniques can be either direct (e.g. chemical analysis) or indirect (e.g. percent of methylene chloride in solvents based on the MSDS). The direct measurement techniques tend to be costly. For those processes common to the electroplating

industry, the EMS prototype provides guidance on those direct and indirect means (Figure 8) of measuring processes common to the industry

Figure 8: Likely Measurements: Metal Finishing:

➢ Volatile organic content of certain materials entering the facility
➢ Levels of metals (PBT, 433/413, other) in the wastewater
➢ Water and Electrical Energy Use
➢ Hexavalent Chromium Stack Emissions
➢ Quantities of materials (PBT, RCRA, other sent to Landfills

EMS Prototype for the Metal Finishing Industry: Support Elements

The identification or development of significant aspects, objectives and targets, programs, operational controls and measuring and monitoring all require various support elements. Support elements are those tasks or functions that the company needs to have in place in order to properly implement and maintain the EMS across the entire facility. The following support elements are required by the standard.

Training

Each employee in the organization is to have training in regards to the EMS policy, the EMS system, and Emergency Response. Those workers whose electroplating operations are associated with a Significant Environmental Aspect are to receive additional training on the operational controls and potential impacts associated with their work.

To training typically need take no more than 15-20 minutes, and can be integrated into department meetings, or other training programs

Figure 9. Training Typically Associated with EMS implementation

➢ Management Overview (optional): 1-2 hrs
➢ Implementation Team (optional): 6-8 hrs
➢ General Awareness (required): 20 minutes
➢ Significant Aspects (required) 1 hour
➢ Internal Auditor (optional): 8-16 hours

Documentation and Document Control

In short, the document control system is intended to ensure that those required to conform to a particular action request under the EMS will obtain the most recent version of the work practice describing what needs to be performed. Documents that must be controlled include the Policy, Procedures, Work Instructions related to Significant Aspects, and Forms for collecting environmental data as evidence of performance. Note that once a Form is completed it becomes a Record. Records are particular data sets that are not intended to change, therefore they do not need to be under Document Control.

Emergency Response Plan

The Emergency Response Plan should address the response to emergency incidents, including those incidents that may occur when the operational controls surrounding high-risk activities fail. Emergency Response plans need to be under the Document Control System and the Standard has a requirement that practice drills be performed.

Communication

The company is to have written procedures of how it intends to communicate environmental information horizontally and vertically across the company. This is particularly important for national multi-facility organizations. Similarly, there must be written procedures on how the company intends to handle comments from interested parties (e.g. public, news media, and governments) outside of the organization. The communications log, the log that records the nature, if any, of the response to an inquiry, is a controlled document. Views of interested parties are to be considered when determining the Significance of environmental aspects.

Internal Auditing

The ISO 14001 Standard requires that an Internal Auditing team routinely audit the facility. The Audit can include a determination that all core and support elements specified in the standard are operating as intended. A determination can also be made of the General EMS Awareness by the company staff. Mere attendance at awareness training is not sufficient, workers must be aware of, and understand the EMS Policy, the EMS system, and how to address an observed emergency (as indicated in the Emergency Response Plan). The audit will also focus on the procedures and work instructions to ensure staff is aware of the procedures/instructions and are performing their tasks in a manner consistent with the written word.

Management Review

At least once a year Top Management should review: summaries of the Internal Audits, summaries of the company's Environmental Performance, any outstanding non-compliance issues, and the progress made towards the company's Objectives and Targets. Management may then implement changes in the organizations EMS Policy, revise Objectives, or take action to correct any EMS system non conformances or non-compliance with the company's legal and other requirements.

Conclusions

The ISO 14001 Standard continues to gather momentum within the United States. Environmental Management Systems, with or without Certification to the Standard, are being consider by most Fortune 500 companies and is filtering down through the supply chain. Small to mid-sized companies are somewhat at a disadvantage of learning from their peers. However, some leaders in the job shop sector have already started the process of ISO 14001 Certification. In general, members of the metal finishing industry have been proactive towards the environment in the past. Early indications are that there exist managerial and financial benefits to ISO 14001 Certification. Given the common processes shared electroplating and metal finishing companies, EMS implementation and ISO 14001 Certification can be cost effective.

A prototype has been developed based on the lessons learned with ISO 14001 Certification and a clear understanding of the environmental issues confronting the metal finishing industry. The prototype offers small to mid-sized companies the opportunity to align the EMS with their business goals and in combination with implementation tools reduce the overall cost of implementation.

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