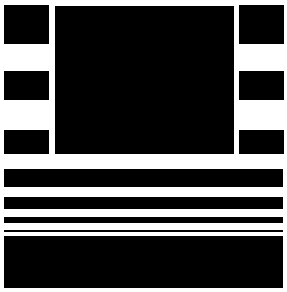


THE MASSACHUSETTS
TOXICS USE REDUCTION INSTITUTE

ENVIRONMENTAL MANAGEMENT SYSTEM WORKGROUP
SURFACE FINISHING SECTOR
HOSTED BY PHOTOFABRICATION ENGINEERING, INC.

TOXICS USE REDUCTION INSTITUTE
CLEANER TECHNOLOGY
DEMONSTRATION SITES PROGRAM

Methods and Policy Report No. 20 **2000**

University of Massachusetts Lowell

ENVIRONMENTAL MANAGEMENT SYSTEM WORKGROUP
SURFACE FINISHING SECTOR

Host Company:
Photofabrication Engineering, Inc.
Milford, Massachusetts

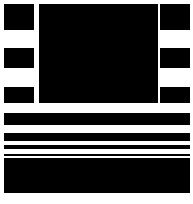
Consultant:
Capaccio Environmental Engineering, Inc.

Funding Organization:
Toxics Use Reduction Institute
Chris Ford, Project Manager

The Toxics Use Reduction Institute
Cleaner Technology Demonstration Sites Program

The Toxics Use Reduction Institute
University of Massachusetts Lowell

2000



The Toxics Use Reduction Institute is a multi-disciplinary research, education, and policy center established by the Massachusetts Toxics Use Reduction Act of 1989. The Institute sponsors and conducts research, organizes education and training programs, and provides technical support to promote the reduction in the use of toxic chemicals or the generation of toxic chemical byproducts in industry and commerce. Further information can be obtained by writing the Toxics Use Reduction Institute, University of Massachusetts Lowell, One University Avenue, Lowell, Massachusetts 01854.

Preface

The Massachusetts Toxics Use Reduction Institute annually provides direct funding to Massachusetts industries to facilitate the development, use and demonstration of innovative techniques that reduce the use of toxic chemicals or the generation of toxic by-products.

In its 1993 fiscal year, the Institute initiated the Industry Matching Grants Program, which provided funding on a matching basis for toxics use reduction (TUR) feasibility and technology studies. Grants were awarded on a competitive basis for companies to conduct TUR studies at their facilities. Grant recipients prepared project reports which assisted in transferring information about toxics use reduction technologies and methods to other companies.

In its 1996 fiscal year, the Institute launched the Cleaner Technology Demonstration Sites Program. The goal of the program was to promote the adoption of cleaner technologies by Massachusetts industry. Five companies were selected as demonstration sites to showcase the implementation of technologies that embrace the concepts and principles of toxics use reduction. The program, which included a series of visits to the facilities with related presentations and publications, allowed individuals and firms to observe and assess the value of those technologies. Site visits were open to all interested stakeholders, including: industry, environmental groups, community groups, the media and others.

In its 1997 fiscal year, these two programs were combined.

Due to significant interest by stakeholders in environmental management systems, the Institute broadened the scope of "technologies" to be demonstrated in fiscal year 2000 to include management tools. The Institute piloted an Environmental Management System Workgroup, which was hosted by Photofabrication Engineering Inc. The following report is a summary of the Environmental Management System Workgroup (Surface Finishing industrial sector) activities.

Notice

This report has been reviewed by the Institute and approved for publication. Approval does not signify that the contents necessarily reflect the views and policies of the Toxics Use Reduction Institute, nor does the mention of trade names or commercial products constitute endorsement or recommendation for use.

This report was authored primarily by Karen Thomas, Consultant.

Introduction

A well-conceived and implemented environmental management system (EMS) addresses both the short- and long-term environmental impacts of a company's products, processes, and services. It provides the structure by which environmental impacts are analyzed, objectives are set, resources are allocated, performance is reviewed and documents are tracked. It also identifies opportunities to integrate environmental performance into the overall business management system, allowing companies to potentially realize cost savings through improved management of their environmental performance.

In recent years many companies have established EMSs to organize their approach toward satisfying identified company environmental compliance requirements and to ensure their ability to anticipate ever-evolving environmental expectations. Industry trade groups have developed EMS guidelines specific to their industry. Regulatory agencies also have recognized the value of EMSs and are encouraging certain elements in their regulatory work.

For the past decade, the Massachusetts Toxics Use Reduction Institute (the Institute) has been training Toxics Use Reduction Planners on planning strategies and techniques designed to assist companies in reducing their use of chemicals and improving their chemical use efficiency. Because many of the components of Toxics Use Reduction planning mirror those of EMS planning, and due to increasing interest in EMSs from Massachusetts companies, the Institute developed the EMS workgroup concept to assist companies in adopting and implementing environmental management systems. This report describes the process and outcomes of the first EMS development workgroup convened by the Institute.

The objective of the project was to provide an opportunity for similar sector companies to share specific tools and lessons learned as each company worked independently and concurrently to develop their EMS. The workgroup concept was designed to take advantage of the Institute's research and training capabilities to assist a number of companies simultaneously. Specifically, the Institute expected that the workgroup format would provide the following:

- A structured format for companies to learn from peers implementing EMSs;
- Tools which could increase the efficiency of the EMS development process for the participating companies;
- An impetus for workgroup members to achieve EMS milestones; and
- A forum for discussion and resolution of difficulties identified during the EMS development process with an emphasis on achieving continual progress and improvement.

Over a six month period beginning in January 2000, a group of Massachusetts surface finishing company representatives met once every four to six weeks to discuss issues related to EMS development. Photofabrication Engineering, Inc. (PEI) hosted the group through a grant from the Institute's Cleaner Technology and Demonstration Sites and Matching Grant Program. PEI, a chemical etching company that manufactures both decorative and industrial products, hired Capaccio Environmental Engineering (Capaccio) to assist them in developing their EMS.

Report Organization

The purpose of this report is two-fold: to describe the workgroup process and to present outcomes from this surface finishing workgroup. The report is therefore divided into two sections. In the first section, a background on EMSs and workgroup meeting summaries are provided followed by conclusions about the EMS workgroup process. In the second section, workgroup meeting notes, tools and examples are offered without further discussion.

This report is not necessarily meant to offer specific guidance on implementing environmental management systems, although it does offer useful information on the topic. For this type of information, please refer to the following reports:

- NSF International, "Environmental Management System Guide for Metal Finishers", (Ann Arbor, MI), December 1998, http://www.nsf-isr.org/html/iso_14000.html.

- US EPA, Office of Pollution Prevention and Toxics, "EMS: A Design for Environment Approach, Draft" (Washington, DC), March 1999, http://www.epa.gov/opptintr/dfe/tools/ems/manual.html.

Part I: EMS and the Workgroup Process

Background on EMS

Numerous environmental management system guidelines and models have been developed by individual companies, industry trade associations, regulatory organizations, quality assurance associations, and international coalitions. These frameworks have been designed to assist stakeholders in ensuring compliance with environmental regulations and in organizing environmental data. Some EMSs are certifiable to a standard while others are not. In the United States, Responsible Care®, developed by the Chemical Manufacturers Association (now the American Chemistry Council), and Total Quality Environmental Management, developed by Global Environmental Management Initiative, are two of the early and popular EMS models. Internationally, the British standard BS7550 – Specification for Environmental Management Systems, and the European Eco Management and Audit Scheme (EMAS) enjoyed early popularity. (For additional information on these models, refer to Appendix A.)

While the Toxics Use Reduction Institute does not endorse any specific environmental management system, PEI chose to follow the now dominant industry EMS standard, ISO 14000.

ISO 14000

Many companies are now familiar with the 9000 series of international standards dealing with quality systems, established by the Organization for International Standardization. As a continuation of this standardization process, the ISO[1] 14000 series of international standards for Environmental Management Systems were finalized in September 1996. These standards were developed to assist organizations throughout the world to achieve environmental and economic gains through the implementation of effective environmental management systems.

ISO 14001 requires implementation of an EMS in accordance with defined standards. The standard specifies requirements for establishing an environmental policy, determining environmental aspects and impacts associated with the products, activities, and/or services of the company, planning environmental objectives and identifying associated measurable targets, implementation and operation of programs to meet those objectives and targets, checking the efficacy of the system and conducting necessary corrective action, and providing management review of the system.

Companies must be certified to the ISO 14001 standard by an independent third-party auditing body. With increasing frequency, certified companies are requiring similar certification by their suppliers. As a result, this standard is gaining in popularity worldwide as companies realize economic benefits from implementation of the ISO 14001 standard

In the four years since the standard was finalized[2], approximately 23,720 companies worldwide have certified to the standard . Japan currently leads the world with over 5,300 ISO 14001 certifications. As of January 2001, the United States was ranked fifth, with 1,340 certified companies.[3]

Federal and State Environmental Programs

Companies in the United States operate within a well-established environmental regulatory system. In Massachusetts, the U.S. Environmental Protection Agency (EPA), the Massachusetts Department of Environmental Protection (DEP), in addition to other local agencies, regulate industries through a variety of regulatory initiatives including the

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[1] "Iso" is derived from the Greek word "isos" meaning equal or uniform, and indicates the organization's objective of providing a level playing field for industries covered under the standard, acknowledging that individual countries have varying levels of environmental regulation.

[2] As of January 2001

[3] This data was obtained at the following web site: http://www.ecology.or.jp/isoworld/

Clean Water and Air Acts, the Emergency Planning and Community Right-to-Know Act, and the Massachusetts Toxics Use Reduction Act. When considering implementing an EMS, it is important for industries to clearly articulate their regulatory programs' commitments within the EMS.

As a means of improving compliance with their regulatory programs, the U.S. EPA is committed to encouraging organizations to use EMSs that improve compliance and environmental performance. In an effort to assist companies to understanding how environmental responsibilities relate to their business operations, EPA has been requiring companies with compliance problems to implement EMSs. In response to EPA's "Innovation Task Force Report, Aiming for Excellence: Actions to Encourage Stewardship and Accelerate Environmental Progress" (July 1999), EPA developed a draft action plan regarding its commitment to the use of EMSs[4]. Specifically, EPA is committed to the following:

- Developing a stronger, more far-reaching assistance program;
- Developing additional tools that can help organizations integrate environmental planning with other business decisions; and
- Continuing and expanding research on what kinds of EMSs are most effective, and how the growing use of EMSs may affect EPA's programs and policies.

The Massachusetts Department of Environmental Protection (DEP) has prepared the following EMS Vision Statement:

> "DEP believes that implementation of effective environmental management systems can improve an organization's environmental performance. To this end, DEP is supportive of any organization seeking such results."

DEP has identified the following four "guiding principles" for their work with EMSs[5]:

- Lead by Example;
- Educate and Raise Awareness;
- Encourage; and
- Continue to Evaluate Regulatory Compliance.

The Institute and EMS

In accordance with its goal of assisting industries in Massachusetts to achieve environmental performance leadership through toxics use reduction, the widely accepted view that EMS help promote sounder corporate environmental policies, and continued regulatory focus on the benefits of encouraging industries to develop EMSs, the Institute has begun efforts to provide opportunities for training and peer mentoring on the EMS

[4] For additional information, see the EPA website at http://www.epa.gov/ems.
[5] For additional information see the Massachusetts DEP website at http://www.state.ma.us/dep/bspt/ems/emshome.htm.

frameworks that might best satisfy their needs. The Institute has offered, and continues to offer, general EMS training to Toxics Use Reduction Planners. In addition, the Institute is working with the University of Massachusetts in Lowell on developing and implementing an EMS (using the ISO 14001 model) for the Olney Building, which houses the majority of the chemistry and chemical engineering laboratories. As part of its on-going mission to provide timely and valuable assistance to industries covered under the Toxics Use Reduction Act, the Institute conducted its first EMS peer mentoring work group for a specific industry sector during fiscal year 2000.

Summary of the Workgroup Meetings

The host company and their consultant prepared presentations on a specific element of their EMS development for each workgroup meeting. Workgroup participants were encouraged to discuss their successes, lessons learned and tools concerning the specific topic of the day and to ask questions of PEI or their consultant. Workgroup meetings were designed for active participation by all members.

The First Meeting

In the first meeting, the group discussed environmental management systems in general, potential benefits of an EMS, the specific requirements of ISO 14001, environmental policies, environmental aspects, environmental impacts and planning.

The following were offered as potential benefits of an EMS:

- Increased awareness of environmental issues, concerns and responsibilities;
- Accountability of all stakeholders to the success of the EMS;
- Use of root cause analysis rather than a "band-aid" approach to corrective action;
- Systematic approach to managing environmental issues;
- Cost savings; and
- Decreased risk / liability.

Major points of the specific aspects of the ISO 14001 EMS model used by the workgroup were discussed with the following focus:

- The environmental policy sets the all-encompassing sense of direction for the EMS and provides a backdrop for establishing and reviewing goals and objectives. It is a useful tool for communicating with employees about the EMS.

- An environmental aspect is an element of an organization's activity, product or service that can have a beneficial or adverse impact on the environment.

- An environmental impact is the change that takes place in the environment as a result of the aspect. It is a requirement of ISO 14001 to determine the facility's aspects and

impacts so that all employees are encouraged to consider the potential environmental impacts of their jobs.

- Planning is an important component of the EMS. This is the step where the facility analyzes their environmental aspects.

The Second Meeting

In the second meeting, the discussion on aspects and impacts continued. The importance of clear project management was discussed. Specifically, the group discussed the concern that, without an EMS champion in the company, the project could easily fail. The EMS champion was identified as an advocate for the program, who makes sure that the project stays on track and acts as a liaison to upper management.

Training and awareness issues were discussed along with the need for clear and timely communication. EMS training must be organized under a control system to ensure that all employees receive the necessary training. The work group discovered that the EMS format provides a good opportunity to combine environmental, safety and quality training under one umbrella. Internal (i.e., with company employees) and external (i.e., with concerned stakeholders outside of the company) communication must be considered in the EMS and both are necessary for its success.

The Third Meeting

Documentation is a central aspect of an EMS. For companies with few formal controls, a significant amount of new documentation may be necessary in developing an EMS. For companies with a well-developed quality system or well-organized environmental records, the additional documentation may be minimal. In the third meeting, document control and operational control were discussed. The EMS documentation system must not only describe the core elements of the EMS, but also provide direction. Document control is a key component of ISO 14000. Operational control requires that the facility demonstrate the ability to control operational activities that are critical from an environmental perspective. The Institute was interested in pointing out that elements of Toxics Use Reduction planning dovetail well with the requirements for both document and operational control within the EMS.

The Fourth Meeting

In the fourth meeting, the important roles of emergency preparedness and response were discussed. Through the careful development of an EMS and incorporation of associated regulatory requirements for these activities into the EMS, a facility will be better positioned to respond to emergencies.

Testing, monitoring and measurement of the efficacy of the EMS, and the importance of auditing, both internally and by an independent third part, were discussed. For a certifiable EMS, the audit process is fundamental. This is the process by which the EMS

is verified as to whether it conforms to the audit criteria set by the certification body. It is also the system by which results of this process are communicated to management. It is important to note that, though not required under the ISO 14001 format, the company's actual compliance status with respect to applicable regulatory requirements can be determined and, if necessary, improved through the effective use of auditing.

The Fifth Meeting

Meeting five covered corrective action procedures, record keeping systems, management review and continual improvement.

Checking includes the monitoring, measurement, and recording of the characteristics and activities of the companies operation that may have significant impact on the environment. Corrective actions can be identified and conducted as a result of the checking procedure. Review of the EMS by the organization's top management must be performed to ensure its continuing suitability, adequacy and effectiveness. Finally, the need to commit to continual improvement through the implementation of its EMS can be accomplished through the cyclical process of planning: implement, check, review and continually improve.

Conclusion

The EMS development workgroup program for the Massachusetts surface finishing sector met the Institute's expectations for learning and information exchange. Informal discussions with workgroup participants suggest that the workgroup was helpful to them in thinking about their own environmental management systems. The similar industry sector concept allowed for technical discussions around specific processes and EH&S aspects and impacts in addition to EMS process development information. Sharing of strategies was also enhanced by the similarities in existing management systems and industry practices between participants.

In order to improve future workgroups, it was suggested that the meetings be extended beyond six months to allow a more reasonable time-frame for EMS implementation. Perhaps a schedule of one meeting every second month would be helpful to allow more time in between meetings to accomplish EMS tasks at participants' facilities. It was also suggested that inviting an auditor to speak at a meeting would be helpful for those companies seeking certification.

Having piloted the environmental management system development workgroup in the surface finishing industry sector in Massachusetts, the Institute is preparing similar workgroup programs for the electronics and plastics industries. These workgroups will expand on the lessons learned in this pilot program, and will be used to evaluate the benefit of industry sector peer mentoring versus models used by other entities, including focusing on industry commitment and timeframe considerations.

Part II: Notes from the Workgroup Meetings

Copies of the overhead slide presentations for each meeting are included in Appendix B. A list of all documents distributed before and at each meeting, as well as copies of the more pertinent documents, is included in Appendix C. Copies of these documents can be obtained by contacting the Institute; they are also available in the Institute's library.

ISO 14001 REQUIREMENTS

4.0 General
The organization shall establish and maintain an EMS, the requirements of which are described in this clause.

4.1 Environmental policy

4.2 Planning
4.2.1 Environmental aspects
4.2.2 Legal and other requirements
4.2.3 Objectives and targets
4.2.4 Environmental management programs

4.3 Implementation and Operation
4.3.1 Structure and responsibility
4.3.2 Training, awareness and competence
4.3.3 Communication
4.3.4 Documentation
4.3.5 Document control
4.3.6 Operational control
4.3.7 Emergency preparedness and response

4.4 Checking and Corrective action
4.4.1 Monitoring and measurement
4.4.2 Non-conformance and corrective and preventive action
4.4.3 Records
4.4.4 EMS audit

4.5 Management review

Meeting 1: January 6th, 2000

This meeting served as an introduction to environmental management systems, and specifically to ISO 14001, which is the system that PEI had chosen to adopt. Capaccio Environmental Engineering, Inc. delivered the introductory presentation to representatives of nine surface finishing companies.

An environmental management system can provide a company with the opportunity to integrate environmental performance into the business management system, and to view environmental performance in broader terms rather than focusing only on compliance. By moving beyond compliance, companies can review all environmental performance aspects and potentially find cost savings by better managing those aspects.

An environmental management system can include issues that may be outside of traditional regulatory programs, including: water use, energy use and toxics use at the production unit[6] level.

The potential benefits of an EMS include the following:

- Increased awareness of environmental issues, concerns and responsibilities;
- Accountability;
- Root cause analysis rather than a band-aid approach to corrective action;
- Systematic approach;
- Cost savings; and
- Decreased risk / liability.

[6] The Toxics Use Reduction Act (1989) defines a production unit as a process, line, method, activity, or technique or a combination or series thereof, used to make a product.

Environmental Policy

The environmental policy sets an all-encompassing sense of direction for the EMS and provides a backdrop for establishing and reviewing goals and objectives. It must be communicated to employees and available to the pubic. It should include a commitment to continual improvement and prevention of pollution, and a commitment to compliance. It was noted that while ISO 14001 defines "prevention of pollution" as including treatment after waste generation, TURI encourages companies to include a more aggressive commitment to "source reduction" pollution prevention in their policies.

Example Environmental Policy

Company X understands that it has a moral responsibility towards the total environment, and that this responsibility is also tied to its success as a business enterprise.

All of our employees share in the ongoing task of striving for compliance with all applicable environmental regulations. By the installation and proper maintenance of the appropriate process technologies we will endeavor to prevent pollution by our activities. In addition, Company X recognizes that it makes good economic sense to conserve our natural resources and to manufacture its products in an environmentally efficient manner. Fundamental to this effort is the need to consider improving everything we do that has a significant impact upon our environment.

Company X commits itself to a leadership position within the XX industry by regularly reviewing those impacts on the environment that are determined to be significant and establishing goals and targets that will reduce those impacts.

Planning

The workgroup discussed the following 11-step implementation strategy:

1. Obtain management commitment;
2. Appoint an EMS team;
3. Conduct a Self-Assessment gap analysis;
4. Address key components;
5. Alert all employees;
6. Conduct a pre-certification review;
7. Submit application and EMS;
8. Receive a certification audit;
9. Conduct follow up on any identified non-conformances;
10. Obtain ISO 14001 registration; and
11. Perform on-going register surveillance audits.

PEI put these steps into a what-who-when-how matrix to track accountability and timelines, as shown in the following table.

WHAT	WHO	WHEN	HOW
Obtain management commitment			
Appoint ISO 14000 Team			
Etc.			

The workgroup discussed the difference between an environmental aspect and an environmental impact.

An environmental aspect is an element of an organization's activity, product or service that can have a beneficial or adverse impact on the environment.

An environmental impact is the change that takes place in the environment as a result of the aspect.

There are many different methods for identifying aspects/impacts, including the following:

- By specific process operation or activity;
- By department or functional area; and
- Whole facility approach.

Example of Environmental Aspect: an industrial wastewater discharge, a process air emission, or use of material.

Example of Environmental Impact: contamination of air, water, or land; or depletion of natural resources.

PEI chose to use the process operation or activity method, where they began with all of their processes and activities and determined aspects and impacts from them.

The method used to evaluate aspects and impacts to determine which are "significant" must be consistent, reproducible and reasonable. In order to be certified to the ISO 14001 standard, a company must be able to demonstrate this. A matrix or other ranking system is an invaluable tool in doing this[7]. Following are some considerations for evaluation.

- Environmental concerns:
  - Scale of impact
  - Severity of impact
  - Probability of occurrence
  - Permanence of impact

- Business Concerns:
  - Legal concerns
  - Cost to address
  - Technical difficulty
  - Effect on other activities and processes
  - Effects on customer and public image

After all significant aspects and impacts have been identified, feasible objectives should be determined[8]. Metrics to measure success should be established, and a program implemented to achieve established targets.

Example Objective:
Minimize amount of energy used to heat process water

Example Target:
Reduce amount of energy used to heat water by 10% over the next 18 months.

[7] PEI used a 0 (none)-1 (low)-3 (moderate)-5 (high) numerical rating system for each criterion.

[8] Note: The group discussed the imperative to not commit to anything in the EMS that your company does not have the resources to complete. If the EMS says that the company will do something, it will be held accountable for this action in an audit.

Meeting 2: February 10, 2000

This meeting continued the discussion on aspects and impacts. As a result of their work up to this point, PEI identified eight significant aspects and impacts that would be pursued according to each component's rated priority.

On these eight significant projects, options for meeting the target were weighed and compared by the standards used for assessment at a facility. For companies that are familiar with the TUR planning process, this is a familiar technique – technical, environmental, health and safety and cost assessments. Once the team has decided on an option to recommend, it must be communicated to management in a manner to ensure its completion.

For each significant aspect and impact, PEI recommended that industries consider the following:

- Environmental objectives [what you hope to accomplish];
- Legal requirements [which regulations apply, if any];
- Other requirements [initiatives to which you subscribe];
- Technological options [better to examine two or more];
- Financial options/incentives [your capital appropriations system];
- Operational requirements [how will this impact production];
- Business requirements [planning for future expansion, new product considerations];
- Views of interested parties [internal or external groups];
- Prime option [your recommendation to senior management];
- Secondary option [there should always be an alternative]; and
- Budgetary cost for prime option [including installation, permitting, etc.]

A sanitized copy of PEI's aspects and impacts metrics is attached (Appendix C).

Project management, specifically who is responsible for and when something will be accomplished, was discussed. These decisions should be adapted to reflect a company's existing method of project management. PEI used a who-what-when-how matrix to track responsibilities and timelines. While it is not required in ISO 14000 to publicly post this information, there may be a benefit in doing so in that people may be more apt to follow through when their name is publicly associated with a task. One drawback is that if the project does not get done, someone may be identified as a barrier to the success of the EMS.

Finally, as part of the project management element, an ISO 14001 Management Representative, who establishes and implements the EMS requirements and reports on performance to senior management, must be chosen.

Training and Awareness

One of the requirements of ISO 14001 is that training must be organized under a control system. PEI collected information on all the applicable environmental training at its facility (e.g., Hazardous Waste Generator Training) and detailed the audience and associated schedule. Safety training and quality training can also be included in this list[9].

Communication

External communication must be managed through the EMS system. A procedure must be developed for responding to questions from outside an organization. Responses to telephone or written questions from the press, public or interest groups as well as responses to visitors must be addressed. It must be clear who is responsible for such inquiries.

Internal communication is critical for the success of an EMS. The process for internal communication must include what is to be communicated (e.g., policies, aspects, impacts, objectives, targets) and how it should be communicated (e.g., through on-site training, videos, computer-based learning modules, bulletin boards, etc.)

Meeting 3: March 16, 2000

Allegro Microsystems, a member of the working group, hosted this meeting at its facility in Worcester, Massachusetts.

Allegro used a chemical-based approach to analyzing its aspects and impacts, with a 0-1-2-3-4-5 numerical rating system for both frequency of aspect occurrence and severity of potential impact[10]. A copy of Allegro's aspects and impacts rating system is attached (Appendix C). Examples of some of the environmental impacts evaluated include:

- Water use;
- Electric power use;
- Fuel use;
- Wastewater;
- Hazardous waste;
- Air emissions;
- Effect on local community (uncontrolled gas release);
- Whether specifically regulated; and
- Human accident risk.

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[9] Note: In the section of the EMS that deals with emergency response, if a yearly (for example) emergency response drill is planned, note that if a spill or other emergency is responded to, that serves as the yearly training exercise. If this is not noted, in order to be in compliance with the system, it will be necessary to also hold a drill.

[10] Note: The aspect and impact analysis does not have to be part of the EMS documentation. At Allegro, it is a proprietary, working document that is referenced in the EMS documentation.

Allegro also included non-environmental "business" considerations in its analysis of aspects and impacts, as shown on the rating system matrix in Appendix C.

Specific numbers were chosen to define 0-1-2-3-4-5 where appropriate. For example, for raw material cost, 0=<$500, 3=<$50,000, etc.). While it was a painstaking process to get consensus on each of these definitions, it resulted in a defensible, consistent, and transferable system that is straightforward to implement.

Document Control

The documentation system must:

1. Describe the core elements of the EMS; and
2. Provide direction.

The system can be paper-based or electronic. The document control requirements of ISO 9000 are almost identical to those of ISO 14001, so if an ISO 9000 program already exists at a facility, it can be adapted to include the other ISO 14001 elements.

There must be a process to maintain documents that addresses the following issues:

- Where do we keep the documents?
- Who has copies?
- Are they reviewed? If so, what is the mechanism that triggers the review?
- Who is in charge of revisions and removal of obsolete documents?

Under ISO 14001, facilities must have a designated document control coordinator who maintains the master copy of the EMS and distributes the EMS and revisions.

Operational Control

An important part of implementing the EMS is to identify those operations that are associated with significant impacts. All aspects/operations with significant impacts must have written procedures. In addition, any requirements for control of those operations that are identified must be communicated to vendors or contractors who supply products/services with a significant impact. This is the opportunity for the facility to communicate pollution prevention requirements to its vendors/suppliers. This type of communication can occur on the purchase order, and can require that the vendor will meet or exceed an environmental target.

Establish standard operating procedures (SOPs):

- Document what you do;
- SOP document placed under control;
- Insure that people know where to find the SOP, and what you do.

PEI Example: Hazardous waste management is a significant aspect of PEI's operations. Deviation from regulatory requirements could lead to compliance issues. Therefore the daily management activities were compiled into a SOP.

The group discussed the necessary and appropriate level of detail required for SOPs, and which procedures should have written SOPs. More written and detailed documentation will result in more operational control, but increases the work required to document and maintain the system. For example, it is not necessary to write the procedure for belt loosening and replacement, just write "change belt."

Meeting 4: April 20, 2000

PEI's emergency response plan takes advantage of existing systems such as their contingency plan. At this meeting, representatives of Allegro Microsystems presented details of their Integrated Contingency Plan (ICP)[11]. This plan combines similar regulatory requirements for emergency response and preparedness planning associated with the following:

OSHA: HAZWOPER (Emergency Action Plan Process Safety Management)

RCRA: Hazardous Waste Contingency Plan

EPA: Oil Pollution Prevention Regulation, Facility Response Plan

USCG: Facility Response Plan

DOT/RSPA: Facilities Response Plan

CAAA: Risk Management Plan

A significant amount of training is required for the ICP, and it is all documented under the ISO 14001 program. Allegro suggests the following tips:

- Invite a spill response contractor to the facility to review the physical lay-out and other plans/response capabilities;
- Host the fire department on a tour of the facility to:
  - Present the contingency plan,
  - Discuss the company's capabilities,
  - Discuss the fire department's capabilities;
- In all plans, include information regarding facility shut offs for gas, water and electricity; and
- Paint critical valves bright colors, post shut off instructions, and have necessary tools in a safe place so they will be available when needed.

[11] Note: Allegro used the FEMA-141 document: "Emergency Management Guide for Business and Industry."

In addition to the requirements of a contingency plan, a company should consider the following questions:

- Have you planned for emergencies in bulk storage and delivery of raw materials?
- Is training adequate? (Link to training and awareness.)
- Who will be your spokesperson? (Link to communication.)
- Are agreements in place with response agencies?

Testing

The ISO 14001 standard requires that "the organization shall also periodically test such procedures where practicable." Considerations in planning for testing of the EMS include:

- Methods to test plan;
- Hazardous waste regulations have a requirement that the plan should be changed if found to fail in an emergency;
- If you have never had an emergency you can't know if the plan will actually work; and
- You can devise a practical exercise that will not only test your plan but also cover the regulatory training requirement (this is often more useful than sitting in a class).

Monitoring and Measurement

Under ISO 14000 and other EMS frameworks, the importance of monitoring your environmental programs (goals and objectives) and measuring your progress is stressed. Anything that is determined to have significant environmental impact should be routinely monitored.

A facility's compliance with environmental regulations must be regularly evaluated by means of regulatory compliance audits. The ISO 14000 standard states that "the organization shall establish and maintain a documented procedure for periodic evaluations of compliance with relevant environmental legislation and regulations."

These can be conducted by internal personnel familiar with the EMS and the applicable environmental regulation, or by an independent third party. If an internal team is used, care must be taken to watch out for "blind spots." The facility should establish frequency (perhaps 18-24 months) of the audits and the scope of the audits.

Examples of PEI's EMS Monitored Aspects:

- Wastewater treatment daily inspection logs;
- Hazardous waste storage area (weekly) and tank (daily) inspection logs;
- pH calibration check procedure and records; and
- Waste disposal/recycling summary.

In addition to regulatory compliance, facilities should establish systems to measure the following:

- Progress towards objectives and targets (link to communication);
- Key operating parameters;
- Monitoring equipment calibration and maintenance; and
- Environmental performance.

Existing activities that can be readily integrated into an EMS monitoring program include:

- Preventive maintenance programs, which provide existing monitoring activity;
- Any type of inspection that is done on processes or equipment that has a significant impact;
- Activities that monitor the performance of your suppliers; and
- Tracking systems that monitor air, water, energy or waste discharges (these can be used to highlight reductions through postings and can be linked with Communication).

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Continual Improvement

There are three main drivers of continual improvement:

- Internal auditing;
- Corrective action process[12]; and
- Management review.

Corrective Action Procedures

The following three issues suggest what to do following a problem:

- Document that an issue has been addressed;
- Escalate up the chain of command if required; and
- Should have a provision to address the root cause of the issue.

A well-designed corrective action form will include elements that allow a root cause analysis to be performed. For example, if a pump is leaking, you need to go further than simply fixing the pump. The root cause may be that the preventive maintenance schedule must be changed. In addition, the corrective action plan can be used to correct compliance issues and address system weaknesses.

[12] It was suggested that a numbering system be implemented to help categorize issues that arise, and that the categorization would be useful to track improvement in certain areas of the system.

Record Keeping System

Documents are a history of what has occurred. They cannot be changed or altered. At a minimum the documentation must satisfy regulatory requirements.

As part of a successful record keeping system, it is necessary to determine the following:

- Who will manage the documents?
- How will they be kept?
- Where they will be kept?
- How long will you keep them?

Audits

The following basic elements comprise an internal audit system:

1. Audit scheduling and notification – develop an annual schedule and communicate it;
2. Form an audit team, need trained system auditors;
3. Understand the EMS requirements - prepare an audit checklist (e.g., to examine each of the 17 standard clauses for the ISO 14000 standard);
4. The audit process must include record reviews, walk-through inspections and staff interviews; and
5. Prepare an audit report that provides a mechanism to address deficiencies.

EMS internal audits will help a facility determine if the EMS is properly implemented and maintained.

Management Review

Involvement of senior management is critical to the overall success of the EMS. Management commitment drives the EMS development and implementation process. The frequency of the review should be established by management. In the management review process, the following should be discussed:

- Internal audit results;
- Results of objectives and targets;
- Compliance audit results; and
- Funding for new objectives and targets.

Management review is important because:

- It provides the management representative with the opportunity to raise issues to top management;
- It confirms the commitment of management to the EMS;
- It examine if the relevancy of the policy based on current operations;
- The minutes from the management review meeting are usually audited; and
- It completes and begins a new EMS implementation cycle.

Bibliography

Cascio, Joseph, Ed., “The ISO 14000 Handbook,” (CEEM Information Services: Fairfax, VA), 1996.

Toxics Use Reduction Institute, “Implementation of ISO 14001 at the Acushnet Rubber Company, Inc., Technical Report No. 37,” (TURI: Lowell, Mass.), 1997.

Appendix A

Responsible Care®

Initiated in 1988 by the Chemical Manufacturers Association (CMA), Responsible Care® is a program where companies pledge to manage their businesses according to the Guiding Principles of Responsible Care, placing a high priority on the protection of the environment, the health and safety of their employees and the public, and the implementation of the Responsible Care management practices. To accomplish this, a companies environmental, health and safety, and Responsible Care activities must be conducted within a structured system that is integrated with their overall management activity. Responsible Care serves as a framework for an Environmental Management System. Economic and regulatory benefits are among the potential benefits of pursuing Responsible Care®.

While Responsible Care® is not technically certifiable, companies may also participate in the Management Systems Verification process, which requires them to open their corporate headquarters and selected facilities to teams of industry reviewers and members of the public. The teams review the companies' environment, health and safety procedures as well as their transportation, product stewardship and outreach activities. For more information on Responsible Care®, Management Systems Verification and related activities, see the website of the Chemical Manufacturer's Association at http://www.cmahq.com.

TQEM

Born of Total Quality Management philosophy of the 1980's, the Global Environmental Management Initiative developed Total Quality Environmental Management (TQEM), almost a decade ago. The main goal of TQEM is continuous improvement of environmental performance. The basic elements of TQEM are as follows: identify your customers, continuous improvement, do the job right the first time, take a systems approach to work. For additional information, refer to the Global Environmental Management Initiative's website at http://gemi.org/.

Other Certifiable Environmental Standards

The first standard on environmental management systems was the British standard, BS7550 – Specification for Environmental Management Systems. This standard tends to be more prescriptive than the ISO 14001 standard. It has not been widely adopted outside of the United Kingdom.

The Eco Management and Audit Scheme (EMAS) was established by European Law in 1995 and is administered by individual member states of the European Union. It has received support throughout Europe but is less popular outside of the European countries. As of July 2000, a total of 3,018 companies have been certified to the EMAS standard, the majority of those in Germany.

Appendix B

Copies of Overhead Presentations

Appendix C

Materials Distributed Before or at Meetings

- ❒ Environmental Management System Guide for Metal Finishers, NSF International, Ann Arbor, MI, December 1998. http://www.nsf-isr.org/html/iso_14000.html

- ❒ Acushnet Rubber Company's ISO 14001 Program, EPA's Design for the Environment Bulletin Number 1, July 1998, EPA 744-F-98-004. http://www.epa.gov/opptintr/dfe/tools/ems/bulletins/bullet01/

- ✯ PEI Environmental Policy
- ❒ Duralectra Company Policy and Aspects & Impacts list by process

- ✯ PEI Aspects and Impacts Matrix (see following attachment)
- ❒ General Process for estimating chemical emissions
- ❒ Acid waste stream example
- ❒ Aspects and Impacts assumptions
- ✯ Allegro Microsystems Aspects & Impacts Analysis System (see following attachment)
- ✯ Sanitized example of an analysis of 14 chemical substances used at Allegro

- ❒ Regulatory calendar for reports, permits, and audits
- ❒ Environmental and safety program including policy and program goals

- ✯ Environmental objectives and targets tracking form

- ❒ IPC[13] Safety Program: 2000 Environmental Training Plan

- ✯ PEI Environmental process, documentation process
- ❒ ADTEC Planning, Legal and Objectives and Targets procedures
- ❒ Procedures for writing procedures
- ❒ Document Control Procedures

- ❒ CMBEN EHS Regulations Matrix
- ❒ Integrated Contingency Plan (ICP) Guidance
- ❒ Allegro's Emergency Preparedness & Response Plans and Procedures
- ❒ Allegro's ICP presentation to LEPC

- ❒ EPA Region IX Metal Finishing EMS Template

✯ Indicates that this document is attached in this report.

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[13] Formerly Institute of Interconnecting and Packaging Electronic Circuits, now IPC - Association Connecting Electronics Industries, see http://www.ipc.org/html/