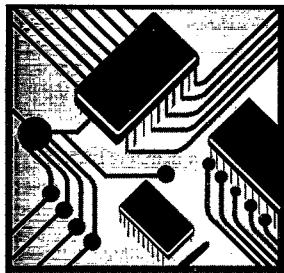




design^{FOR THE} ENVIRONMENT

PRINTED WIRING BOARD CASE STUDY 8

PRINTED WIRING BOARD PROJECT



This case study introduces the initial steps necessary for developing an EMS, and shows the similarity between the requirements for ISO 14001 and ISO 9000.

Do You Need an EMS?

As companies strive to improve their management of environmental issues and increase profits at the same time, many have found that an EMS can do more than improve their environmental performance — it can help them meet their business goals too. By providing a systematic way to review and improve operations for better environmental performance, an EMS can help a company use materials more efficiently and streamline operations.

Building an Environmental Management System: H-R Industries' Experience

Creating an environmental management system (EMS) might seem like an overwhelming task, especially for a small or medium-sized company, but many of the elements needed for an EMS may already be in place at your facility. Such elements as your procedures to track environmental compliance or your state-required pollution prevention plans can be used directly to give you a significant head start for developing your EMS. Many printed wiring board (PWB) manufacturers are paying particular attention to EMSs, since they are the basis of ISO 14001 certification.

One company, H-R Industries, found that their existing ISO 9000 Quality Management System gave them a significant advantage in ISO 14000 certification. H-R Industries became the first PWB manufacturer in the U.S. to obtain ISO 14001 certification. The company was established in 1976 and is a wholly owned subsidiary of McDonald Technologies, Inc. With approximately 300 employees at facilities in Richardson and Bonham, Texas, the company produces a wide range of multi-layer boards.

The ISO 14001 system, the international standard for environmental management systems, was closely modeled on ISO 9000, and as a result, there is significant overlap between the two standards. Many of the elements are similar, and some are nearly identical. Management systems, whether for quality or environmental protection, share common elements including developing and documenting procedures, training, recordkeeping, auditing, and corrective action.

Companies that have implemented EMSs have experienced benefits such as:

- better environmental performance
- cost savings in operations
- increased efficiency of operations
- resource conservation
- lower insurance costs
- improved public relations

Even companies not pursuing certification are using the ISO 14001 model for their EMSs because it is quickly becoming the industry standard for environmental management. By basing your EMS on the ISO framework, you can go on to apply for certification under ISO 14001, if it makes sense for your company. **Any company can reap the benefits of an EMS, whether or not the company plans to obtain ISO certification.**

First Steps in Creating an EMS

Getting management buy-in and assessing your current practices up-front will save you a lot of time when developing your EMS.

Gain management commitment. Upper management can demonstrate their commitment by playing an active, visible role in the EMS implementation process, providing funding and allocating resources, and promoting employee awareness and motivation. An EMS should be viewed as a tool to achieve continuous envi-

ronmental improvement, rather than daily "firefighting" just to keep up with regulatory requirements.

Review your current environmental programs. Once you have management commitment, the next step is to conduct and document a preliminary review of your company's current environmental programs and management systems. This process includes reviewing your existing environmental management policies, operating procedures, and training programs, as well as your methods for identifying your regulatory requirements.

Determine what's missing. Next you need to evaluate how closely existing procedures conform to the requirements of an ISO 14001 EMS. Such a "gap analysis" identifies the actions necessary to build your EMS. To do this, you'll need to compare your existing procedures to the five main stages of an ISO 14001 EMS.

- ① Environmental Policy
- ② Planning
- ③ Implementation and Operation
- ④ Checking and Corrective Action
- ⑤ Management Review

Repeating these five steps forms a cycle of continuous EMS improvement, with the overall goal of improving environmental performance.

Links Between ISO 14001 and ISO 9001

If your company is ISO 9000 registered, the gap analysis may reveal that many of the materials already prepared for your quality system will be helpful in developing your EMS. This is because ISO 9000 and ISO 14000 use similar management frameworks. Table 1 provides an outline of the ISO 14001 EMS standard and shows corresponding ISO 9001 elements, where they exist. The ISO 9001 standard is used for comparison in this case study because it is the most comprehensive of the ISO 9000 series of standards. Most of these comparisons are also applicable to facilities registered under ISO 9002.

The most direct linkages with ISO 9001 occur within three phases of the EMS: Implementation and Operation, Checking and Corrective Action, and Management Review. The elements addressed within these phases, such as organizational structure and responsibility, training, document and records control, and audit and management review requirements, have direct parallels within the ISO 9001 system. In some cases, however, there is no direct link between ISO 14001 and ISO 9001.

The H-R Industries Experience

H-R Industries has been active in reducing the environmental impact of its operations in past years through changes such as using glycol-free strippers and aqueous solder masks. The

company viewed the creation of a formal EMS and ISO 14001 certification as a way to achieve discipline in its environmental programs, incorporate environmental responsibility into all job descriptions, demonstrate industry leadership, and gain a marketing advantage.

When in-house staff at H-R Industries conducted a gap analysis, they found that they would be able to borrow significantly from their ISO 9002 Quality Management System. The overlap included using the same forms and stamps to indicate document approval, and using the same procedures and personnel for documentation control.

In general, the company used the same documentation system for writing EMS policies and procedures as it had for its quality program. Specific examples of how H-R Industries used its quality system to develop several EMS elements are described below.

① **Environmental Policy.** H-R Industries modified its Quality Policy to include its environmental policy. The policy was enlarged to poster-size, signed by all employees, and posted as a reminder of the company's commitment.

② **Planning.** A key element of an effective EMS is identifying the environmental aspects of your company's activities, products, and services, and determining which aspects have significant impacts on the environment. These "significant aspects" form the basis for setting your environmental objectives. Although there is no parallel element in ISO 9002, H-R Industries extended its ISO 9002 purchasing policy to address potential environmental impacts by making suppliers and contractors aware of the environmental aspects associated with their products. For example, the formality of an EMS provided the incentive to work with a chemical supplier to convert their permanganate bath maintenance procedure. Sodium hypochlorite additions were replaced by permanent electrodes in the solution for electroregeneration, extending bath life 2 to 3 times. This change resulted in reductions in hazardous waste generation, material handling, reporting, and recordkeeping. Annual savings totaled over \$32,500.

③ **Implementation and Operation.** Essential to both quality and environmental management systems is the assignment of responsibility, authority, and adequate resources. To make the most of limited resources, H-R Industries assigned the same individuals responsibility for both quality and EMS elements where there was overlap. For example, the Safety/Health Officer provides training required by ISO 9002 and ISO 14001. Documentation and records for the Quality and Environmental Management Systems are controlled and maintained by the same individual.

Successful implementation of an EMS also depends on both management and employees fully understanding and controlling the company's potential impact on the environment. H-R Industries uses the training framework already in place for



ISO 9002, safety, and employee right-to-know programs to inform new employees of ISO 14001 EMS requirements. Training had to be expanded to educate employees about the environmental aspects of their activities and the potential environmental consequences of their performance. For example, platers needed to know that dumping a contaminated bath to wastewater treatment could not only disrupt the treatment system, but also may cause an unacceptably high level of metals discharged to the environment.

According to H-R Industries' Process Engineering Manager, "With ISO 9002, quality had to become everybody's business. With an EMS, everybody had to become aware of how their work impacted the environment." For example, wastewater treatment operators revised procedures to address environmental aspects of treatment operations.

④ **Checking and Corrective Action.** H-R Industries

transferred its ISO 9002 procedures for making corrective action requests directly to its EMS. The EMS Manual simply refers to the Corrective Action Request form already in use for quality. For example, such a form might be used for a tank leak. Similarly, H-R Industries incorporated the records control and audit procedures established under ISO 9002 into its EMS.

⑤ **Management Review.** Management must periodically review the EMS to evaluate its suitability and effectiveness. ISO 9001 contains the same requirement. Although there is some overlap in personnel on the quality and environmental review committees at H-R Industries, the two systems are reviewed separately. The review format and control of meeting records, however, is the same. H-R Industries feels that smaller companies may have an advantage in the review process in that the committees may be composed of the same

Table 1: Similarities Between ISO 14001 and ISO 9001

Shading indicates where similarities exist between the two systems.

ISO 14001 Element	ISO 9001 Equivalent
4.1 General Requirements	4.2.1 General
4.2 Environmental Policy	4.1.1 Quality Policy
4.3 Planning	
4.3.1 Environmental aspects	Although there is no direct equivalent in ISO 9000, opportunities for considering environmental aspects may exist in areas such as contract review, purchasing, handling, storage, packaging, preservation, and delivery.
4.3.2 Legal and other requirements	
4.3.3 Objectives and targets	
4.3.4 Environmental management programs	
4.4 Implementation and Operation	
4.4.1 Structure and responsibility	4.1.2 Organization
4.4.2 Training	4.1.8 Training
4.4.3 Communication	
4.4.4 EMS documentation	4.2.1 General
4.4.5 Document control	4.5 Document and data control
	4.3 Contract review
	4.6 Purchasing
4.4.6 Operational control	4.7 Control of customer-supplied product
	4.9 Process control
	4.15 Handling, storage, packaging, and delivery
4.4.7 Emergency preparedness and response	
4.5 Checking and Corrective Action	
4.5.1 Monitoring and measurement	4.11 Control of inspection, measuring and test equipment
4.5.2 Nonconformance and corrective and preventive action	4.14 Corrective and preventive actions
4.5.3 Records	4.16 Control of quality records
4.5.4 EMS audit	4.17 Internal quality audits
4.6 Management Review	4.1.3 Management review

personnel, allowing both quality and environmental systems to be reviewed at the same time.

Lessons Learned About the EMS Process

The process of developing an EMS for a small or medium-sized company need not be overwhelming. H-R Industries' experience shows that a company can use its existing environmental policies and procedures, and those developed for ISO 9002 registration, to help build an EMS that is integrated with its quality assurance program. H-R Industries' advice is to begin with simple, achievable goals, and focus on programs where there is obvious economic benefit. As your EMS matures, the procedures and programs can be expanded to further improve environmental performance and to continue integration of the EMS into other business functions.

Time required to develop and maintain the EMS: The time required to implement an ISO 14001 EMS depends on the current status of your company's environmental programs, the resources your company is willing to commit, and whether your organization is ISO 9000 registered. At H-R Industries, it took about 18 months to obtain certification. During the first year it took the equivalent of one fourth of an employee's time for preliminary planning and exploring issues. The final 6 months required the time-equivalent of 1.5 employees to implement the EMS. For a company without a well-developed system, implementation may take about 2 years. At H-R Industries, one full-time employee maintains both environmental and quality systems; several other employees have EMS responsibilities requiring the time equivalent of an additional half-time employee.

Certification cost: At H-R Industries, certification cost \$18,000, which included preliminary and on-site audits, follow-up audit for deficiency, audit report, registration fee, and auditor time and expenses. H-R Industries saved on auditor expenses by scheduling the ISO 14001 certification audit and the ISO 9002 six-month surveillance audit at the same time and with the same firm.

Acknowledgments

EPA's DfE Program would like to thank H-R Industries for participating in this case study, along with DfE PWB Project participants from Circuit Center, Inc., and Concurrent Technologies Corp., who provided advice and guidance.

What is the Design for the Environment (DfE) Printed Wiring Board Project?

The U.S. Environmental Protection Agency's (EPA's) Design for the Environment (DfE) Printed Wiring Board Project is a cooperative, non-regulatory effort in which EPA, industry, and other interested parties are working together to develop technical information on pollution prevention technologies specific to the PWB industry.

Additional Resources for the PWB Industry

In addition to this case study, the DfE PWB Project has prepared other case studies that examine pollution prevention opportunities for the PWB industry. All case studies are based on the experiences and successes of facilities in implementing pollution prevention projects. The other case study topics available include:

Pollution Prevention Work Practices

On-Site Etchant Regeneration

Acid Recovery and Management

Plasma Desmear

Reusing Microetchant

Pollution Prevention Beyond Regulated Materials

Identifying Objectives for Your Environmental Management System

These case studies, and other documents published by the DfE Project, are available from:

Pollution Prevention Information Clearinghouse

U.S. EPA 401 M Street, SW (7409)

Washington, DC 20460

phone: 202-260-1023; fax: 202-260-4659

e-mail: PPIC@epamail.epa.gov

DfE PWB information: <http://www.epa.gov/dfe>

or www.ipc.org/html/ehstypes.htm#design

The DfE Program welcomes your feedback. If you implement any of the ideas in this series of PWB case studies or have any comments, please let us know by calling the DfE Program at 202-260-1678 or via e-mail at oppt.dfe@epamail.epa.gov.



Recycled

Printed on paper that contains at least 50% recycled fiber.

U.S.