Abstract

Innovative companies recognize the importance of addressing environmental issues in the earliest stages of product development. Several approaches have been initiated to facilitate the integration of environmental requirements in the design process. Both "life cycle design" and "design for environment" (DFE) are systems approaches which focus on the life cycle of a product. The life cycle encompasses, raw materials acquisition, bulk and engineered materials processing, manufacturing, use, service, retirement, resource recovery and disposal. Life cycle assessment (LCA) is a methodology for evaluating the environment effects associated with this product system. LCA has received much attention over the past two decades but the application of the life cycle framework to design is more recent. The purpose of this paper is to present current research by the University of Michigan and AT&T on life cycle design and its application.

The life cycle design framework was developed through a cooperative research project with the U.S. EPA Risk Reduction Engineering Laboratory. The framework is documented in Life Cycle Design Guidance Manual: Environmental Requirements and the Product System (EPA 600/R-92/226). Two demonstration projects evaluating the practical application of life cycle design are being completed with AT&T and Allied Signal, Corporation. After providing an overview of the life cycle design framework, major findings from the AT&T demonstration project will be presented and discussed.

The purpose of the life cycle design framework is to guide the integration of environmental requirements into product system development and implementation. The product system includes product, process, distribution, and management components. The ultimate environmental goal is sustainable development, which will be shaped at the corporate level by design initiatives emphasizing pollution prevention and efficient resource use. The incorporation of sustainable development principles into a firm's product development process requires significant organizational and operational changes.

The organizational support for life cycle design within a corporation is provided by its environmental management system. Elements of this system include the environmental policy,
goals and performance measures, dedicated resources, a clear division of functional
responsibility, efficient information management, and training. This system provides both
direction and incentives for fully integrating environmental objectives into product system
development. Multi-stakeholder involvement from designers, process engineers, environmental
health professionals, marketing, accounting, and product development managers is also
fundamental to life cycle design.

Successful implementation of life cycle design requires changes at the operational level.
The product development process consists of the needs analysis, specification of requirements,
and conceptual to detailed design steps. Designers and other relevant decision makers require
access to environmental information throughout this process, which is often not readily available.
Specification of design requirements is particularly critical. Environmental goals can not be
translated into successful products without meeting cost, performance, cultural, and legal
requirements. A Multi-criteria Requirements Matrix was developed to facilitate the
identification of requirements and the resolution of conflicts between requirements using tradeoff
analysis.

The purpose of the AT&T Life Cycle Design Demonstration Project was twofold: 1) evaluate the effectiveness of the life cycle design guidelines and 2) use the life cycle design
framework to evaluate the AT&T’s program for integrating environmental requirements into
product system design. A business phone was selected for this demonstration project. Results
from the demonstration will be highlighted including a description of AT&T’s environmental
management system and specific design strategies used to reduce the environmental impacts
associated with the business phone.