TOXICS USE REDUCTION INSTITUTE

THE MASSACHUSETTS TOXICS USE REDUCTION INSTITUTE

Fact Sheet 2

Design for the Environment

what is Design for the Environment?

Design for the Environment (DfE) is an engineering design initiative that promotes environmentally sound decisions at every step of the production process from chemical design, process engineering, procurement practices, and end product specification to post-use disposal. The concept is developing in the environmental/engineering fields and is beginning to gain public recognition.

where did the concept come from?

The idea emerged among environmental professionals in the American Electronics Association (AEA) during the late 1980s. DIE follows the popular engineering concepts of "concurrent engineering," "design for manufacturing," and "design for disassembly." AT&T has been a strong promoter of the concept. The U.S. Environmental Protection Agency (EPA) began an internal dialogue on the idea of DfE in 1991. Parallel concepts in Europe appear to have predated the AEA work, particularly in the areas of package design and industrial design.

why consider DfE?

During the last six years, growth of interest and initiatives around the concept of pollution prevention and toxics use reduction has been significant. Firms around the world are beginning to recognize that it is far more efficient to prevent the generation of industrial wastes than to manage the wastes once they areproduced. In the U.S., environmental engineers increasingly are engaging production engineers around reduction of waste streams from manufacturing processes. Yet this is only one avenue for bringing about environmentally sound production processes. The opportunity to consider environmental effects at the earliest design points in the development of new products or the redesign of current production processes opens up an exciting new area of professional work.

DfE's holistic approach is part of the broader concept of industrial ecology, first introduced to the general public in 1989 by Robert Frosch and Nicholas Gallopoulos, research scientists at General Motors. The industrial ecology view promotes sustainable manufacturing through the modeling of industrial processes after the material and energy flows of the natural environment. An industrial ecosystem follows a cyclical model in which the consumption of energy and materials is optimized, waste generation is minimized, and the byproducts of one process become raw material for another.

DfE pursues industrial ecology principles by requiring that industrial designers and managers think in terms of cycles or complex systems rather than traditional linear process flow diagrams. DfE locates environmental concern within the most positive stages of the production process. Rather than trying to mitigate environmental consequences of production after the products have been defined and the processes designed, DfE encourages consideration of environmental issues to help shape the context of the industrial designer or process engineer in the same way that manufacturability, cost competitiveness, and consumer satisfaction currently shape that context.

Components of DfE

- product design
- packaging design
- product life-cycle analysis
- process engineering
- product design specifications
- engineering design education

How can DfE be promoted?

Industry is beginning to consider the environmental impact of a product throughout its life cycle, primarily because of regulatory trends and rising treatment and disposal costs. Corporations are also recognizing the potential economic advantage of DfE. But more training, technical information, and industry-specific knowledge of DfE are needed to bring about its broad-scale implementation.

Efforts to develop and integrate DfE into the production of products and services are under way in the public and private sectors. EPA's Design for the Environment Program, operating from the Office of Pollution Prevention and Toxics, is engaged in voluntary collaborative projects with industry, education, and the public at two levels:

Cooperative Industry Projects foster the development and use of DfE tools and principles in specific industries through the evaluation of alternative materials and processes in terms of their comparative risks, performance, and costs. Current

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University of Massachusetts Lowell • One University Ave • Lowell, Massachusetts 01854-2881
Telephone: (508)934-3275
FAX: (508)934-3050

projects involve the printing, dry cleaning, and computer and electronics industries. EPA seeks to establish projects with other industry segments as well.

Infrastructure Projects take a long term approach aimed at changing aspects of general business practices and developing incentives for environmental design. Work is under way with insurance and accounting professionals to incorporate pollution prevention considerations into analytic accounting and insurance risk management and underwriting systems. A grant program with universities and the National Science Foundation funds research into alternative approaches for the design and manufacture of chemicals. EPA also funds the development of university and college curricula that apply DfE principles in courses in business, engineering, and natural resources.

Several industries, particularly automotive and computer and electronics manufacturing, have initiated DfF efforts. A major thrust of these efforts is the design of products that can be recovered from end users and disassembled for recycling, remanufacture, or reuse. Other efforts include the American Electronics Association's DfE task force which produces a series of white papers on aspects of DtE; the American institute of Architects' DfE programs for architects; and a major industrial initiative called the Design for Disassembly, Service and Environment Consortium. U.S. and Canadian industries and government agencies are participating in development of a North American Guideline for Environmental Design that will assist industrial designers and executives in meeting DfE principles.

How can DfE promote Toxics Use Reduction?

While TUR focuses on reducing the use or waste of toxic substances within existing industrial processes, DfF moves the focus of this effort to an earlier phase of the product life cycle. DfE considers environmental factors while products and processes are still on the drawing board. Essentially, TUR would be pre-built into industrial products and processes that were designed for the environment.

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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 reduction in the use of toxic chemicals or the generation of toxic chemical byproducts in industry and commerce.

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