



# Design for the Environment Computer Display Project



## What Is Design for the Environment?

EPA's Design for the Environment (DfE) Program is a voluntary initiative that forms partnerships with a variety of stakeholder groups in an effort to:

- Encourage businesses to incorporate environmental concerns, in addition to the traditional criteria of cost and performance, into their decisions.
- Effect behavior change to facilitate continuous environmental improvement.

To accomplish these goals, the program uses EPA's expertise and leadership to evaluate the human health and environmental risks, performance, and cost of traditional and alternative technologies, materials, and processes. DfE disseminates information on its work to all interested parties and helps businesses implement cleaner technologies identified through the program.

The program has formed cooperative partnerships with the following industries:

- Printed wiring board
- Computer display
- Printing
- Garment and textile care
- Auto refinishing
- Industrial/institutional laundry

## Assessing Life-Cycle Impacts



### Why Is EPA Working With the Display Industry?

Each year, millions of desktop computer monitors are manufactured and sold worldwide. Monitors that use cathode ray tubes (CRTs) currently dominate the global marketplace, as

CRTs provide rich, high-resolution displays well-suited to a range of applications.

Flat panel displays (FPDs) have emerged on the electronics market as a replacement for CRTs in certain applications, primarily because FPDs are lighter, smaller, and more portable, and they consume less energy during operation. One type of FPD, liquid crystal displays (LCDs), are used primarily in notebook computers, but are beginning to move into the desktop market. The potential life-cycle environmental impacts of both CRTs and LCDs have not yet been adequately assessed.

EPA's Design for the Environment (DfE) Program has entered into a voluntary partnership with the electronics industry to evaluate the life-cycle environmental impacts, performance, and cost of CRT and FPD technologies used for desktop computers (LCDs). The project will generate data to assist original equipment manufacturers (OEMs) and suppliers in the electronics field to incorporate environmental considerations into their decision-making processes and identify areas for improvement.

### What Are the Project's Goals?

The primary purpose of the DfE Computer Display Project is to evaluate the life-cycle environmental impacts of FPDs and CRTs by combining Cleaner Technologies Substitutes

Assessment (CTSA) and life-cycle assessment (LCA) approaches. Developed under the DfE program, CTSA's evaluate and compare substitute processes, products, or technologies, and generate data that allow businesses to make environmentally informed choices. Human and ecological risk, energy and resource use, performance, and costs are evaluated in a CTSA.

LCAs examine the full life cycle of a product, from materials acquisition to manufacturing, use, and disposition. LCAs are comprehensive methods for evaluating the full environmental impacts of a product system.

In this project, these two methodologies will be used to study display technologies that perform standard applications on 15- to 17-inch



desktop computer monitors. The technologies that meet this criteria include CRTs and two types of thin-film transistor active-matrix LCDs (twisted nematic and in-plane switching). In addition to evaluating environmental impacts, information on the relative performance and cost of CRT and LCD technologies will be collected from industry and summarized.

These evaluations will provide information to help the electronics industry:

- Consider alternative technologies, materials, and processes that reduce releases of toxic chemicals, conserve resources, and lower risks to human health and the environment.
- Perform an improvement assessment of display technologies and their components.
- Meet the growing global demands for extended product responsibility.

### **What Kind of Work is Being Conducted by the Project Team?**

Project participants include display manufacturers, OEMs, trade groups such as the U.S. Display Consortium (USDC) and Electronic Industries Alliance (EIA), academic and research organizations, such as the University of Tennessee (UT) and the Microelectronics and Computer Technology Corporation (MCC), and public interest groups, like the Silicon Valley Toxics Coalition.

Under a grant from EPA, and with the assistance of MCC, the CTSA/LCA study is being conducted by UT's Center for Clean Products and Clean Technologies. UT and other project participants are evaluating the environmental impacts of display technologies throughout their entire life cycle. The team will develop estimates of environmental impacts from the following processes:

- Raw material extraction or acquisition
- Material processing
- Product manufacture
- Product use
- Disposition at end of life

UT and other project participants also will characterize exposure and chemical risk from selected chemicals in one or more life-cycle stages of the displays. This assessment will evaluate impacts on human health and organisms in the environment.

The project team will summarize performance and cost information from existing industry data. In addition, the team will assemble as much relevant technical data as possible from existing research. The following studies are possible sources for project team consideration:

- MCC's 1994 *Electronics Industry Environmental Roadmap*, which qualitatively identified general environmental issues and priority needs for reducing impacts from display screens, but was not quantitative and did not address all display life-cycle issues.
- A University of Michigan case study of the environmental performance of an active matrix LCD, which includes some preliminary life-cycle inventory data.
- A New Jersey Institute of Technology life-cycle assessment for television CRTs.
- 1996 Update to: *Research Report on the Visions of the Electronic Display Industry to the Year 2000*, EIAJ (Electronic Industries Association of Japan).
- Research on personal computers (including displays) conducted at the NEC Resources and Environment Protection Labs and National Institute for Resources and Environment.

The results from new studies as well as any analysis generated on existing data will be disseminated to industry OEMs, display manufacturers, and other interested parties.



### **How Can I Get More Information?**

To learn more about EPA's DfE Program or DfE Computer Display Project, contact:

**Pollution Prevention Information Clearinghouse**  
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You may also visit the DfE web site at [www.epa.gov/dfe](http://www.epa.gov/dfe).