

# Introduction

This report summarizes the results of an analysis conducted by U.S. Environmental Protection Agency's Design for the Environment (DfE) Computer Display Project (CDP). The DfE Computer Display Project is a voluntary, cooperative partnership among the DfE Program, the University of Tennessee Center for Clean Products and Clean Technologies, the electronics industry, and other interested parties. The partnership assessed the life-cycle environmental impacts of two technologies that can be used for desktop computer displays. Specifically, it evaluated the traditional cathode ray tube (CRT) technology and the newer liquid crystal display (LCD) technology.

## *PURPOSE AND SCOPE OF THE PROJECT*

The purpose of the Computer Display Project was twofold:

- 1) to assess the life-cycle environmental impacts of CRT and LCD technologies used in desktop computer displays; and
- 2) to develop a model that will expedite future environmental life-cycle analyses for computer display analyses.

To conduct this analysis, a life-cycle assessment (LCA) was used as the environmental evaluation tool. LCA looks at the full life cycle of the product being evaluated, from materials acquisition to manufacturing, use, and end-of-life (i.e., final disposition). While this project assesses CRT and LCD technologies specifically, the model in this study provides a baseline LCA upon which other technologies can be evaluated in the future.

## *NEED FOR THE PROJECT*

At present, CRT computer displays are used far more than any other display technology. CRT monitors are relatively inexpensive and provide a rich, high-resolution display well suited to a wide range of uses. CRT displays are bulky, however, and are associated with disposal problems with respect to their leaded components. Newer technologies, collectively referred to as flat panel displays (FPDs), exhibit desirable qualities, such as reduced size and weight and greater portability, but currently are more expensive than CRT displays. CRTs currently dominate the desktop monitor market. At present, FPDs are used mainly in notebook computers, but their use in desktop monitors is increasing rapidly. Of the several types of FPD technologies, this study focused on active-matrix LCDs. Other FPD technologies were not included in the study because they make up a small fraction of the market and are not targeted for desktop applications. Market predictions indicate continued growth in LCD market share, as shown in the table below.

### *About EPA's Design for the Environment Program*

EPA's Office of Pollution Prevention and Toxics established the DfE Program in 1992 to encourage businesses to incorporate environmental concerns into their business decisions. DfE industry projects are cooperative, joint partnerships with trade associations, businesses, public-interest groups, and academia to assist businesses in specific industries to identify and evaluate more environmentally sound products, processes, and technologies. The DfE Computer Display Project partnership consisted of members of electronics industry trade associations, computer monitor and component manufacturers, electronics industry suppliers, academic institutions, EPA, and a public interest group. The direction and focus of this project was chosen by the project partners.

## Desktop display markets — actual for 1998 and projected for 2001

Technology	Number of displays (thousands of units)	
	1998	2001
CRT	Worldwide	88,600
	North America	33,801
LCD	Worldwide	1,300
	North America	229

Source: DisplaySearch 2001.

Given the expected market growth of LCDs, the various environmental concerns throughout the life cycle of computer displays, and the fact that the relative life-cycle environmental impacts of CRTs and LCDs had not been scientifically established to date, there was a need for an environmental life-cycle analysis of both desktop computer display technologies. As companies or consumers consider investing in certain displays, they can refer to the results of this study to assist them in making environmentally informed decisions. Although this study does not make recommendations or comparative assertions as to which display type is environmentally preferable, manufacturers can use its results to identify areas for improvement concerning the product's environmental burdens. With this information, the U.S. electronics industry may be more prepared to meet the global marketplace's growing demands of extended product responsibility, becoming better able to meet competitive challenges worldwide.

This booklet summarizes the key findings of the DfE Computer Display Project study. The information is presented in ten sections, or questions. The questions summarize:

- the study's life-cycle assessment methodology;
- the environmental impacts associated with the technologies evaluated;
- additional information on the health risks associated with lead, mercury, and liquid crystals;
- information on cost and performance; and
- guidance on where to find more information.

For more detailed information on any of these topics, the reader is encouraged to reference the full project report, *Desktop Computer Displays: A Life-Cycle Assessment* (EPA/744-R-01-004a and b). The document may be viewed at [www.epa.gov/dfc](http://www.epa.gov/dfc).