2004 IEEE International Symposium on Electronics and the Environment  
Phoenix, AZ  
May 10-13, 2004

Environmental and Economic Trade-offs in Cell Phone Materials Recycling

A. K. Bhuie¹, O.A. Ogunseitan¹, A. A. Shapiro², and J-D. M. Saphores³

¹Program in Industrial Ecology, Department of Environmental Health, Science, and Policy, University of California, Irvine; ²Jet Propulsion Laboratory, California Institute of Technology, Pasadena; ³Dept. of Planning, Policy & Design, UCI

¹Corresponding Author (A.K. Bhuie)  
¹Program in Industrial Ecology,  
Department of Environmental Health, Science, and Policy  
School of Social Ecology, University of California, Irvine  
CA, USA. 92697-7070; Tel: 949-824-9845; Fax: 949-824-2056;  
Email: abhuie@uci.edu

Abstract:

Cell phones are the fastest increasing category of consumer electronic products with short useful life expectancies. A typical cell phone contains several hazardous materials; including antimony, arsenic, beryllium, cadmium, copper, lead, nickel, and zinc. Most of the persistent toxicants contained in cell phones are found in the printed wiring board and liquid-crystal display. It is estimated that 200 million cell phones are in circulation among the public in the United States (U.S.); 130 million cell phones are retired each year; and more than 500 million phones are stockpiled. Approximately 70% of cell phones are resold and the remaining units are either recycled or discarded. Therefore, considerable attention has been focused at State, national, and international levels to develop policies that minimize the environmental impact of defunct cell phones. However, there is little consistency in the strategies developed at each legislative level because of different values placed on trade-offs between economic costs and environmental benefits. This study aims at developing a single metric for such trade-offs to facilitate comparisons among alternative policies. A cost model was developed using multidimensional life cycle analysis and monetizing methods to assess environmental impacts. Our results show that the net cost to recyclers of refurbishing and reselling cell phones exceeds the cost to sort, dismantle, and discard scrap metal cell phones. The charge assessed for recycling each cell phone ($6) far exceeds the estimated processing cost (0.45c), and this discrepancy should be factored into policy initiatives being considered to manage the end-of-life disposal of consumer electronic products.

Key words: Cell phone recycling, electronics, economics, environment, toxic materials.