

N.C. DIVISION OF POLLUTION

PREVENTION AND ENVIRONMENTAL

ASSISTANCE

1639 Mail Service Center Raleigh, NC 27699-1639

(919) 715-6500

(800) 763-0136

Generation Estimate for Electronic Discards in North Carolina



Electronics are atypical of many products in the solid waste stream (for example, beverage cans or newspapers) that are discarded soon after use. Electronics are durable products that have opportunities for reuse and repair. Reuse occurs frequently within the generating "unit:" e.g., a household buys a new television or computer and moves the old one to another room in the house. Many electronics are also donated to other users – for example, computers may be given to schools or charities.

Because of these and other factors, discard estimates can only be indirectly derived from use rates or sales. The purchase of a new item does not automatically translate into the discard of an older one. However, ultimately each electronic product – just like beverage cans or newspapers – reaches the end of useful life and must be managed as a discarded material.

The following chart gives a basic overview of the life cycle of a durable electronic device, such as a computer or television. Over time, after a possible period of reuse or storage (or both), all electronics move toward a state of ultimate discard. At that point, only two options will exist for the materials: disposal or recycling.



Making generation estimates for North Carolina is a challenging task. No known direct, state-specific data exists on the disposal of electronic wastes in North Carolina. All known sales estimates for new electronics, which are partial predictors of generation, are national – not state-specific – in scope. North Carolina-based use rates for electronic products are also not readily available. Despite these difficulties, it is necessary to make discard estimates for program and policy planning.

FINDINGS AND METHODOLOGY

This fact sheet presents generation estimates for discarded electronic products in North Carolina based on extrapolations of sales, use and generation data on the national level, as well as estimates of use, generation and disposal from other states. Although indirect, this methodology yields generation estimates for North Carolina that can be useful in building a system to manage these materials. The tables below present the findings of this research. Data sources are discussed in more detail in the sections that follow the tables.

Electronic Products in Use in North Carolina

Based on the life cycle described above, generation can be partially predicted or foreshadowed by current use rates. Using the range of data displayed in the table below, it can be estimated that:

- 6.3 to 6.4 million televisions are in use in North Carolina households alone. This number does not include commercially owned and used televisions; for example, TVs found in hotel rooms.
- 4.2 to 5.6 million personal computers (PCs) are in use in North Carolina.

• At least 7.6 million CRTs are in use in North Carolina households. Assuming CRT use in the commercial/industrial/institutional (CII) sectors is at least equal to the household sector, the total number of CRTs in use is more than 15 million.

Data Source*	Televisions	CRTs	Personal computers
2001 DPPEA fact sheet estimate		7.6 million in households	
Florida study extrapolated for North Carolina	6,420,626 in households		
Georgia study extrapolated for North Carolina	6,308,564 in households	7,965,441 in households	1,697,620 in households 2,545,943 in other settings 4,243,663 total
Data from other sources			5,623,966 total

* See explanations of data sources below

Electronic Discards in North Carolina

As discussed above, electronic discards may go through a cycle of reuse and/or storage prior to recycling or disposal. Thus tonnages generated as "discards" do not necessarily reflect what is currently or annually received at disposal and recycling facilities. Again, however, the materials will eventually reach the stage where they will be presented for either disposal or recycling. An analysis of available data finds:

- The original DPPEA estimates of approximately 50,282 tons to 53,398 tons of video, audio and information electronics generated annually still appear to be reasonable.
- Using a broader definition of electronics to include products like radios, stereos and microwaves, as much as 90,775 to 107,997 tons are generated annually in North Carolina.
- 11,020 to 13,349 tons of televisions and monitors are generated per year by households alone (excluding commercial and other non-household sources).
- Televisions and monitors generated from all sources are between 26,699 and 33,125 tons per year.

The table below presents these generation estimates:

Data Source	Televisions and Monitors	Electronics
1998 DPPEA Market Assessment Estimate	 26,699 tons/CRTs from all sources Approx. 13,349 tons from households 	53,398 tons
2001 DPPEA fact sheet estimate		50,282 tons
Oregon data extrapolated for N.C.		107,997 tons**
Pennsylvania data extrapolated for N.C.		90,775 tons**
Data from other sources	33,125 tons from all sources	
Assumed annual generation from current use*	320,000 household televisions <u>169,762 household monitors</u> 11,020 tons total from households	

*6.4 million televisions in household use as per Table 1 multiplied by an assumed discard rate of 5 percent per year. 1,697,200 PCs in use as per Table 1 multiplied by an assumed discard rate of 10 percent per year. Assumed television/monitor total multiplied by 45 pounds/each.

** The Oregon and Pennsylvania data includes products such as stereos, microwaves, telephones, radios, etc.

Predictions of Generation from Electronic Sales for North Carolina

Because every electronic product sold will eventually reach an end-of-useful-life stage and be discarded, sales data can be used as a partial factor in estimating or predicting generation. One estimation scenario is presented below, using data from eTForecasts, Buffalo Grove, Ill. (see Sales Data and Projections section below). The graph shows projected discard rates of PCs from all sectors (residential, commercial, etc.) bought in the years 2000 to 2004. Note that the analysis does not count materials purchased before 2000; the discarding of these "historic" products would add to the total amount reflected shown in the chart. Nor does it include materials purchased after 2004 that would begin to be discarded in increasing numbers later in the decade. The chart assumes a 10 year discard cycle rate wherein no PCs are discarded in the first two years after purchase; 5 percent are discarded in year 3; 10 percent discarded per year in years 4-5; and 15 percent per year in years 6-10.

The graph shows that by 2010, approximately 1,385,000 units from the 2000-04 sales period are discarded in that year. At an assumed weight of 40 pounds total per unit, PC discards in 2010 would be 27,700 tons.

The graph underscores a critical point about electronics discards: the steady widespread purchase of these products will over time build a larger pool of potential discards. In simple terms, the more society buys – which is driven by consumer demand, technology changes, etc. – the more discards society will have to manage.



EXPLANATION OF DATA SOURCES USED IN GENERATION ANALYSES

Previous Estimates

In 1998, DPPEA estimated the generation of electronic discards as part of its overall Recycling Market Assessment study (see: http://www.p2pays.org/ref/02/0162206.pdf). The calculation relied on studies done by other states and research groups, and assumed factors of household and business CRT ownership, as well as CRT weight and longevity estimates. The market assessment projected 53,398 tons of all electronics would require disposal by 2002, with half of that weight being CRTs.

In 2001, DPPEA made a second estimate (see: http://www.p2pays.org/ref/14/13034.pdf) of electronics generation extrapolating from national data in the EPA document Municipal Solid Waste in the United States, 1999 Facts and Figures (see http://www.epa.gov/epaoswer/non-hw/muncpl/pubs/mswfinal.pdf). This exercise produced a projected overall tonnage of 50,282 per year, with subcategories of video products (television, monitors, VCRs, etc) at 20,746.44 tons; audio products (stereos, CD players, radios) at 8,637.20 tons; and information products (computers, telephones, faxes) at 20,898.66 tons per year. The fact sheet also estimated more than 7.6 million CRTs in use by North Carolina households, which would eventually be discarded.

Data from Other States

Electronics in Use

At least two states have estimated the number of computers and televisions in use. A Florida survey found that 99 percent of households own TVs, with 53 percent owning three or more. Less than 10 percent had at least one

broken TV. The survey also found that 63 percent of households have a computer monitor, but fewer than 3 percent have broken monitors. Thirty-three percent of households surveyed said they plan to dispose of the monitors and TVs, 29 percent plan to repair them, and 23 percent plan to store them. The Florida study estimated that 561,079 TVs and monitors are headed for disposal and 1.4 million TVs and monitors are stored in households.

N.C. Extrapolation from Florida data:

3,100,692 households with at least one TV 1,659,966 households with 3 TVs (4,979,900 total) 269,998 TVs/monitors headed for disposal 698,600 TVs/monitors stored in households

The state of Georgia has estimated that 56.5 percent of households have at least one computer, for a total of 1,739,365 computers in use in residences statewide. For televisions, Georgia estimates 22 percent of households have one TV (661,401 sets), 35 percent have two TVs (2,104,458 sets), and 41 percent have three or more TVs (3,697,834) for a total of 6,463,693 TV sets. Total computer and TV CRTs in use in Georgia households are thus estimated to be 8,161,313.

Georgia also estimates an additional 1,907,273 computers in use in the private sector; 244,982 computers in government jobs; 351,399 computers in Georgia schools grades PK-12; and 104,894 computers in use by university-level students. Total CRT use in Georgia would thus be 10,769,861.

N.C. Extrapolation from Georgia data:

1,697,620 computers in N.C. households 2,545,943 in other settings (e.g. private, government) 6,308,564 TV sets in use in N.C. households

Waste Data

Oregon has conducted a landfill sampling waste composition study that estimated disposal of various waste streams, including computers and televisions. The study found 45,736 tons of electronics, which included computers, monitors and brown goods (which encompasses televisions, VCRs, microwave, radios, telephones and stereos). This broader definition is similar, though not exact, to the data from Pennsylvania described below. *N.C. Extrapolation from Oregon data:* 107,997 tons disposed of in N.C. landfills.

Note: Oregon study discusses relatively lower confidence level in the sampling for computers than for some other waste streams (e.g., beverage containers).

Pennsylvania also conducted a waste composition study in 2001 involving landfill sampling that included "electronics" as one of the sorted categories. Electronics were defined as electrically powered household products fabricated from metals and plastics and not easily separable into individual materials. Examples include hair dryers, radios, stereos, microwave ovens, computers, televisions and telephones. The study found 136,299 tons of electronics disposed in Pennsylvania landfills, which amounts to 1.5 percent of disposed waste stream. *N.C. Extrapolation from Pennsylvania data:* 90,775 tons of electronics disposed in N.C. landfills

• Sales Data and Projections

The following shows one estimate of sales of one type of electronic product: personal computers. Use rates for PCs are also provided by the same source. Previous analyses conducted by DPPEA have also suggested annual sales of PCs in North Carolina to be in the 1.3 - 1.4 million range. Sales of analog televisions (which use a CRT-based display) in North Carolina may account for an additional 750,000 units or more.

U.S. PC Sales:	2000: 46 million	North Carolina share: 1,315,600
	2003: 49.1 million	North Carolina share: 1,404,260
	2006: 58.6 million	North Carolina share: 1,675,960
U.S. PCs in Use:	2003: 687 per 1000	Translated to North Carolina: 5,623,966
	2006: 790.4 per 1000	

Source: eTForecasts, Buffalo Grove, Ill. ts/ES_pcww.htm

Data from Other Sources

Research conducted under the National Electronics Product Stewardship Initiative (NEPSI) provides insight into the

flow of electronic discards. The research arrived at factors for storage, reuse and disposal/recycling of discarded TVs and monitors. In practical terms, the stored and disposal/recycling portions would constitute "generation" as that stage signifies when products are poised or available to be managed as a waste stream. For televisions with potential for discard each year, 43 percent were assumed to go to reuse, another 39 percent to storage, and a relatively small 18 percent to disposal/recycling. For monitors, the percentages were assumed to be 55 percent reuse, 48 percent storage, and 8 percent disposal/recycling. In addition, the units that had been stored and reused for three years were also assumed to become available each year for disposal/recycling.

Extrapolating for the North Carolina portion of national figures used in this research, it was estimated that 733,933 televisions and 738,280 monitors, or 1,472,213 units total, would annually be generated. At an assumed average weight of 45 lbs. each, annual tonnage of television and monitor generation would be 33,125.

THE GAP BETWEEN GENERATION AND RECOVERY: ESTIMATES OF POTENTIAL RECOVERY

One reason to estimate electronics discards is to help communities plan for how much material would need to be handled in public collection programs. Community collection programs are in their infancy in North Carolina and the United States, and public expectation or awareness of recycling options is just beginning to build. Even as recycling programs become available and public awareness increases, electronics will still be discarded, just as half of all newspapers and more than 70 percent of all PETE bottles are disposed in North Carolina despite widespread collection programs for those materials. Moreover, electronics are again subject to relatively high levels of reuse and storage. Because of these factors, neither North Carolina nor its communities can expect to see recovery levels approaching the generation estimates provided above.

One way to estimate "generation" from the standpoint of planning public recovery services is to look at what communities are experiencing in product flow to existing collection programs. In North Carolina, Wake County operates the largest electronics collection program to date. Projected recovery in this program in FY 03 is approximately 530,000 pounds or .8 pounds/per capita/per year. If collection services on par with Wake County's were available statewide, the total pounds handled across North Carolina would be 6,550,406, or 3,275 tons. It is important to note, however, that Wake County does not collect televisions in its program.

Hennepin County, Minn., runs one of the longest-standing recovery programs in the nation and collects about 2.3 pounds of electronic material per capita per year. Assuming that a set of well-organized community collection programs across North Carolina could allow the state to reach this recovery level, the amount of material collected annually would be 9,416 tons statewide.

If North Carolina has an estimated generation of just more than 50,000 tons per year of electronics, the Hennepin County extrapolation would translate into a recovery rate of just under 20 percent. Interestingly, that figure compares with the discard/recycling rate projections discussed for televisions and computers in the *Data from Other Sources* section above. It also compares with the estimated state recovery rate for PETE bottles.

CONCLUSION

The gap between generation and recovery means that electronics are a "latent" waste stream whose full potential impact is unknown. It is clear that the seemingly insatiable consumption of these products will continue to build a pool of obsolete material that users will eventually want to part with, often after a period of reuse or storage. When a household decides to discard these products, the ability to divert them from disposal will clearly depend upon convenient recycling collection options offered by local governments, the electronics industry, and other parties.



The North Carolina Division of Pollution Prevention and Environmental Assistance provides free, non-regulatory technical assistance and education on methods to eliminate, reduce, or recycle wastes before they become pollutants or require disposal. Telephone DPPEA at (919) 715-6500 or (800) 763-0136 for assistance with issues in this fact sheet or any of your waste reduction concerns.

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