

Time Lag and Composition of Durable Goods  
U.S. Environmental Protection Agency  
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***Background***

For this task, EPA's contractor updated the methodology to be used for durable goods in the Characterization of Municipal Solid Waste (MSW) report series, by researching assumptions made on product lifetime and product consumption for durable goods, in particular furniture and furnishings, major appliances, and selected consumer electronics. The storage of consumer electronics was to be included in this review of methodology.

EPA's contractor updated the product lifetime assumptions with available data from industry reports and representatives, trade publications and recyclers as available for future inclusion in EPA's Characterization of Municipal Solid Waste in the United States report series. Staff researched product composition of major appliances, small appliances, and furniture and furnishings within existing life cycle studies and life cycle databases.

The purpose of this memorandum is to summarize recommended changes to product lifetimes and composition of durable goods within the Characterization of Municipal Solid Waste in the United States report methodology.

***Methodology***

EPA's contractor researched whether new information has been made available over the past 5 years with regards to the composition and lifetime of specific durable goods. This research was done through internet searches for public and private documents, life cycle database searches, and phone calls with various associations and industry representatives.

This memorandum presents a brief description of the research done for the lifetime update and the composition update, as well as recommended changes to the lifetimes and compositions of durable goods. Data availability was a definite limitation for this update.

***Lifetime of Durable Goods***

Two-thirds of the research hours targeted the lifetime of furniture & furnishings, major appliances, and consumer electronics. The main search terms used for this research were life expectancy, average lifetime, lifetime + appliances, electronics industry report + life expectancy, life expectancy of home components, electronic trade association, appliance trade association, and product life spans. A total of 13 useful documents were found in this search; more than 30 additional documents were identified but were found without useful information or were unavailable due to the cost of purchasing the report. These documents included international reports, which may limit the data in some specific cases due to differences from country to country (e.g. appliance sizes).

The contractor researched lifetime, recycling, and refurbishment with several companies and was able to find some information in these areas.

Table 1 provides the lifetimes used in the *Characterization of Municipal Solid Waste in the United States: 2011 Facts and Figures*, as well as suggested changes from the research. In some cases, no data were found to support a change in the lifetime. An asterisk has been placed by these lifetimes within the table. A list of references is provided in Appendix A at the end of this memorandum. These references are numbered and used within the table to provide a specific reference.

Although no specific information was found on storage of consumer electronics or durable goods in general, the analysis takes into account the fact that some people do store their old durables for a period of time before discarding them. Time for storage has been included in the suggested lifetime ranges. If the references found provided lower lifetimes than the current lifetime used, the contractor lowered the low end of the range. The same is true if the references provided higher lifetimes for durables considered here.

**Table 1. Lifetime of Durable Goods**

Product	Current Lifetime Temporary Diversion (years)	Suggested Lifetime Temporary Diversion (years)	References
<b>Furniture &amp; Furnishings</b>			
Furniture & Furnishings	10-20	10-20	1,8
<b>Major Appliances</b>			
Air Conditioners, Room	10-20	8-15	1,5,10
Dishwashers	8-16	5-16	1,2,4,5,13
Dryers	15-21	10-18	1,2,5,13
Freezers	10-30	10-30	1,2,4,5,6,7,13
Microwave Ovens	8-16	8-12	1,2,4,5,13
Ranges	15-21	13-22	1,2,4,5,13
Refrigerators	10-25	10-25	1,2,4,5,6,7,10,11,13
Refrigerators Compact	3-7	7-14	1,13
Washers, Clothes	9-17	9-17	1,2,5,10,13
Water Heaters	9-17	9-17	1,2,5,13
Trash Compactors	8-12	6-12	1,2,5,13
<b>Consumer Electronics</b>			
<b>Video Products</b>			
Direct View Color TV	7 - 23	5-20	3,4,10,22
Projection TV	7 - 15	7-15	3,4
HDTV	7 - 23	6-20	4,22
LCD Color TV	9 - 15	6-20	3,4,12,22
Plasma	7 - 15	6-20	4,10,12,22
TV/VCR Combination	10 - 12	3-12	3,4
Videocassette Players	7 - 10	*	
VCR Decks, DVD Players, Camcorders	7 - 10	3-10	3,4
<b>Audio Products</b>			
Home and Portable Audio Products	3 - 15	3-10	3,4
<b>Home Information Products</b>			
Mobile Telephones	3 - 7	3-7	4,10,22
Cordless/Corded Telephones	3 - 8	3-8	3
Telephone Answering Machines	3 - 8	3-8	3
Fax Machines	3 - 8	3-8	3
Personal Computers	3 - 18	3-12	4,10
Personal Computers Laptop	2 - 8	2-8	3,4,10
Computer Printers	4 - 14	*	
Aftermarket Computer Monitors	5 - 13	3-10	10
Personal Computers Monitors - Flat panel	3 - 14	3-10	10
Keyboards	3 - 6	*	9

Mouse Devices	3 - 6	*	9
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\*Lifetime was not changed due to lack of supporting data.

### *Composition of Durable Goods*

The remaining research hours were spent investigating the composition of furniture & furnishings, major appliances, and consumer electronics. This investigation included reviewing the LCA and Input/output databases within Simapro, as well as searching prior LCA or material studies on durable goods.

EPA's contractor first reviewed in-house LCA software, Simapro, for possible durable goods within all databases available. In some cases, such as consumer electronics, the composition data available were specific to components within the individual electronic device, but the overall composition of the whole device was not available. An example would be the availability of the materials within the printed wiring boards and LCD screens, but not the personal computer as a whole. In other cases, usually from input/output databases, data were available for industries as a whole (e.g. plastics industry, wood industry, lumber products). It may be possible to make assumptions and pull out of these databases the type of data required, but this analysis would take more hours than were available, and the data would be considered highly uncertain.

The main search terms that were used for this research were as follows.

- LCA
- Life Cycle Assessment
- MRA
- Material Flow Analysis
- Literature review
- Composition
- Bill of materials
- Eco Management and Auditing Scheme (EMAS)
- Material resource + industry
- Material consumption + industry
- Input output approach to MFA of waste
- WEEE
- Industry associations
- Industry statistics
- Life expectancy tax purposes
- Cost index & depreciation schedules.

A total of 7 useful documents were found in this search, with 14 further documents found without useful information or unavailable due to the cost of purchasing the report. These documents included international reports, which may limit the data in some specific cases due to differences from country to country (e.g. appliance sizes).

Table 2 provides the compositions used for relevant appliances in the current Characterization of Municipal Solid Waste in the United States report methodology, as well as material composition changes suggested from the research. A list of references is provided in Appendix A at the end of this memorandum. These references are numbered and used within the table to provide a specific reference for the changes.

Table 3 provides the compositions used for relevant furniture in the current Characterization of Municipal Solid Waste in the United States report methodology, as well as material composition changes suggested from the research. A list of references is provided in Appendix A at the end of this memorandum. These references are numbered and used within the table to provide a specific reference for the changes. Only office furniture composition information was found in the reports reviewed. Most life cycle analyses are focused on a specific product (e.g. a chair, a desk). In the LCA reference (18), the data were specific to three office furniture products, including a chair, a table, and a desk. The second reference (19) provided wood use in an overview of office furniture systems, which would include the previous reference items, plus filing cabinets, storage units, book cases, etc.

Table 4 provides the compositions used for relevant consumer electronics in the current Characterization of Municipal Solid Waste in the United States report methodology, as well as material composition changes suggested from the research. A list of references is provided in Appendix A at the end of this memorandum. These references are numbered and used within the table to provide a specific reference for the changes.

**Table 2. Composition Percentage of Appliances**

	Material Type							Total Percent	References
	Steel	Copper/ Brass	Aluminum	All Metals Total	Plastic	Glass	Other		
Refrigerator – current	50	4	3	57	38	0	5	100	
Refrigerator – suggested	59	5	3	67	27	0	6	100	14, 16, 7
Dryer – current	98		<1	98	<1		<1	100	
Dryer – suggested				60	29		11	100	14
Washing machine - current	53	4	3	60	22	0	18	100	
Washing machine – suggested	46	3	5	54	25	16	5	100	14, 16, 17
Dishwasher – current	50		5	55	30	0	15	100	
Dishwasher – suggested				42	22		36	100	14
Range stove – current	87	1	3	91	1	6	2	100	
Range stove – suggested	81	7	3		6		3	100	15
Air conditioner – current	55	17	7	79	9	0	12	100	
Air conditioner – suggested	55	17	7	79	11	0	10	100	16

**Table 3. Composition Percentage of Office Furniture**

	Material Type						Total Percent	References
	Steel	Textiles	Aluminum	Wood	Plastic	Other (incl. leather & glass)		
All Furniture - current	32	11	1	45	8	3	100	
Office Furniture – current	26	16	1	57	0	0	100	
Office Furniture – suggested	40	<1	16	32	9	3	100	18, 19

**Table 4. Composition Percentage of Consumer Electronics**

	Material Type									References
	Steel/ Iron	Copper	Aluminum	Other metals	Plastic	Glass	Wood	Other	Total Percent	
Desktop PC (no monitor) – current	40	5	9	6	40				100	
Desktop PC (no monitor) – suggested	69	4	6	1	16			4	100	20
LCD TV – current	25	4		18	24	29			100	
LCD TV – suggested	30	1	4	19	40	6			100	17
Plasma TV –current	22	3		16	7	29	23		100	
Plasma TV –suggested	21	1	19	20	10	29			100	17
Cell phone –current		19	9	16	46			10	100	
Cell phone – suggested	8	14	3	4	60	11			100	21

***Appendix A: Lifetime and Composition References***

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17. Composition information found at <http://panasonic.net/eco/petec/material/>
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