

**Federal Electronics Challenge
Recommended Criteria for Plastics
In New Product Design and End-of Life Management**

**Developed by the FEC Plastics Task Force
Of the Stakeholder Dialogue Project for Recycling Engineering Thermoplastics**

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Principles for Criteria Selection

The following principles guided criteria selection:

- Reduce life cycle environmental impacts
- Sound science supporting criteria;
- Technically feasible;
- Commercially available in proposed timeframe;
- Not cost prohibitive;
- Provides stretch yet attainable target for environmental improvement; and
- Issue/substance is applicable to electronic products

Design Criteria

These recommendations address the environmental performance of electronic products and do not cover criteria such as safety and fire protection. Although equally important, health and safety in all stages of the product life cycle must not be compromised.

1. Recycled Resin

A. The product contains on average a minimum of 5 percent post-consumer recycled resin OR 25 percent pre-consumer recycled resin, measured as a percentage of total resin (by weight) in the product. Recycled content is defined by the Federal Trade Commission as “materials that have been recovered or otherwise diverted from the solid waste stream, either during manufacturing (pre-consumer) or after consumer use (post-consumer)”.

B. Until manufacturers can achieve the above targets, products can earn **partial credit** for recycled resin as follows:

- 1 point for every percent (by weight) of post-consumer recycled resin.
- .2 points for every percent (by weight) of pre-consumer recycled resin.

C. Manufacturers can also be evaluated on their total consumption of recycled resin using the following metrics:

- a. Of the total resins purchased by your company, what percentage (by weight) of plastics used in your electronic products are recycled resins (pre-consumer or post-consumer)?
- b. Of the total resins purchased by your company, what percentage (by weight) of plastics used in your electronic products are from **post-consumer resins**?

Rationale:

The goal of this criteria is to create markets for resins recovered from end-of-life (EOL) electronics and to improve the resource efficiency in the manufacturing of new electronic products. The criteria recognizes that the current limitations of the infrastructure to supply post-consumer resins. The intent is to provide resin processors and equipment manufacturers with the flexibility to cost-effectively meet the challenge initially and incrementally, while providing an incentive to incorporate post-consumer content.

Criteria “A” is a stretch goal. The Task Force recognizes that products are not yet commercially available to achieve these targets. Establishing these targets will provide industry with a clear market signal and long-term objective. Criteria “B” will provide the short-term incentive -- the competitive pressure -- for manufacturers to take incremental steps to incorporate recycled content in products. Criteria “C” offers an alternative metric based on corporate performance in the use of recycled content resin, rather than individual products. This metric will help differentiate those companies supplying “niche” products to the federal government versus those companies making significant advances in the use of recycled content resins.

Post-consumer content from any source is acceptable. Requiring post-consumer content derived from EOL electronic products was viewed as too restrictive, requiring excessive recordkeeping, and ultimately driving up costs.

2. Flame Retardants

The product does not contain pentabromodiphenylether (PentaBDE) or octabromodiphenylether (OctaBDE) in concentrations greater than 0.1%.

*The use of other flame retardants may be restricted in the future if on-going risk assessments indicate a significant risk to human health and the environment.

Rationale:

This criteria aligns with the European and California restrictions on flame retardants. There are currently products on the market that meet this criteria. The criteria allows for the use of decaBDE and TBBPA, unless scientific evidence demonstrates a significant risk to human health and the environment. This criteria promotes recycling, since decaBDE is found in an estimated 40% of recovered electronic equipment. (Per APME, 48% of E&E plastics with flame retardants.) Deca has also been shown to maintain its flame retardant properties when recycled.

3. Heavy Metals

The product does not contain heavy metals in finished molded parts above the maximum acceptable concentration levels: lead (0.1% by weight), mercury (0.1% by weight), cadmium (0.01% by weight), and hexavalent chromium (0.1% by weight).

Rationale:

The maximum concentration levels are consistent with the European Union RoHS Directive.

4. Paints & Coatings

The use of paints and coatings, including metal coatings, on plastic parts > 25 grams should be minimized. Products will be assessed according to the following hierarchy:

- a. no paints & coatings on plastic parts (3 points)
- b. paints & coatings on plastic parts are proven to be compatible with recycling processes and do not significantly impact the physical/mechanical properties of the recycled resin. "Significant" impact is defined as >25% reduction in notched IZOD impact at room temperature as measured using ASTM standard D256. (1 point)

- c. paints & coatings on plastic parts significantly impact the physical/mechanical properties of the recycled resins OR testing has not been performed. “Significant” impact is defined as >25% reduction in notched IZOD impact at room temperature as measured using ASTM standard D256. (-1 points)
- d. parts with >25 percent recycled resin are exempt from the paints and coatings criteria, and receive credit equivalent to (b) for use of compatible coatings. (1 point)

Rationale:

The goal of this criteria is to increase the recyclability and reuse of recovered resins. Certain types or amounts of paints & coatings can negatively impact the physical and mechanical properties of recycled resins. Plastics with paints & coatings may require additional processing steps to remove paints/coatings, which is not always economical.

5. Design for Recycling

- A. Plastic components > 25 grams are material coded in accordance with ISO 11469

Rationale:

Coding plastic parts with resin identification information will facilitate the manual sorting of parts, and increase the potential for creating high value recycled resins.

- B. Plastic enclosure parts do not contain molded-in or glued-on metal unless the use of metal inserts are minimized and are easy to remove with standard tools at end of life.

Rationale:

Molded-in or glued-on metal may be difficult to liberate from plastic parts, increasing potential contamination and decreasing the recyclability and value of plastic parts.

6. Biobased Resins

The product contains resins in which carbon is derived from a renewable resource via biological processes, and the environmental benefits of the biobased resin are demonstrated. This includes resins derived from plant resources (such as starch or cellulose) or produced by microbial fermentation. Resins that are biodegradable (i.e., degrade as the result of naturally-occurring micro-organisms) do not receive credit under this criteria unless the resin is also biobased.

Rationale:

1) The total lifecycle environmental impact of biobased resins can be more favorable than for petroleum based resins. The lifecycle improvements for biobased compared to petroleum based resins are due mainly to reduced energy use and greenhouse gas emissions in resin production. The environmental benefits of biobased resins are expected to increase with additional R&D, full-scale production and optimization of production

processes. 2) This criteria differentiates biobased resins from biodegradable resins. Biobased refers to the origin of the material used to produce the resin, while biodegradable refers to the potential for biological processes to break down the resin at the end of life. Biodegradable resins are not considered a priority for electronic products since these products are not considered a litter problem.

End of Life Management Criteria

Plastics Processing Hierarchy

The following hierarchy provides a tool to evaluate recycling contractors based on the relative environmental benefit of plastics processing and disposition options. Points are cumulative and are awarded based on the percentage of plastics destined for each processing/disposition option. A total of 500 points is possible.

- A. Reuse of plastic parts (5 points X % of total plastics)
Parts are reused in original or similar applications. This does not include the reuse of whole equipment or plastic-containing components (such as circuit boards, motors) destined for component-level reuse.
- B. Mechanical recycling (4 points X % of total plastics)
Processing mixed or single resin plastics (e.g., size reduction, sorting, separating, cleaning) for use in new product applications.
- C. Chemical Feedstock Recycling (3 points X % of total plastics)
Using chemical processes to break down polymers into simpler compounds that can be used as feedstock for manufacturing operations.
- D. Metal recovery/production (2 points X % of total plastics)
Using plastics as a reductant and energy source in the smelting of non-ferrous metals and in the production of ferrous metal.
- E. Energy recovery (1 point X % of total plastics)
Technologies that recover the BTU value of plastics.
- F. Landfill or incineration without energy recovery (0 points X % of total plastics)
- G. Disposition Unknown (-1 points X % of total plastics)

Notes:

- a. The infrastructure to support plastics recycling is currently evolving. As plastics processing options become widely available and economically feasible across the US, disposition options that do not result in the recovery of resins, chemical precursors or energy (i.e., landfill and incineration without energy recovery) should be phased out.
- b. This is a “generic” hierarchy of plastic processing options based on available scientific and market data. The actual environmental benefit and eco-efficiency of plastics processing options will depend on several factors such as part size & metal content of the plastics stream, distance to market, and the processing operation.
- c. Advanced recycling technologies such as chemical feedstock recycling are still in the developmental stage.

- d. The export of plastics should not be restricted. Recovered plastics need to freely enter commerce and the global plastics supply chain. Products containing plastics, including electronic products, are manufactured globally. Recycled resins need to be available where these products are manufactured.

EXAMPLE SCORE:

Recovery Option	Points		% Plastics	Score
A. Reuse of plastic parts	5	X	0	0
B. Mechanical recycling	4	X	20	80
C. Chemical feedstock	3	X	0	0
D. Metal recovery/production	2	X	75	150
E. Energy recovery	1	X	0	0
F. Landfill or incineration	0	X	5	0
G. Disposition Unknown	-1	X	0	0
	Total		100%	230

Sample Product Scorecard

Criteria (Possible 20 points)	Pts
<ul style="list-style-type: none"> <div style="display: flex; justify-content: space-between; align-items: flex-start;"> <div style="width: 60%;"> <p>▪ Flame Retardants (1 point)</p> <p>The product does not contain pentabromodiphenylether (PentaBDE) or octabromodiphenylether (OctaBDE) in concentrations greater than 0.1%.</p> </div> <div style="width: 20%; text-align: right;"> <p><i>Yes/No</i></p> </div> <div style="width: 20%; text-align: right;"> <p>_____</p> </div> </div> 	
<ul style="list-style-type: none"> <div style="display: flex; justify-content: space-between; align-items: flex-start;"> <div style="width: 60%;"> <p>▪ Heavy Metals (1 point)</p> <p>The product does not contain heavy metals in finished molded parts above the maximum acceptable concentration levels: lead (0.1% by weight), mercury (0.1% by weight), cadmium (0.01% by weight), and hexavalent chromium (0.1% by weight).</p> </div> <div style="width: 20%; text-align: right;"> <p><i>Yes/No</i></p> </div> <div style="width: 20%; text-align: right;"> <p>_____</p> </div> </div> 	
<ul style="list-style-type: none"> <div style="display: flex; justify-content: space-between; align-items: flex-start;"> <div style="width: 60%;"> <p>▪ Recycled Resin (10 point maximum)</p> <p>A. The product contains a minimum of 5% post consumer recycled resins OR 25% pre-consumer recycled resins (5 points)</p> </div> <div style="width: 20%; text-align: right;"> <p><i>Yes/No</i></p> </div> <div style="width: 20%; text-align: right;"> <p>_____</p> </div> </div> 	
<p>B. Products earn partial credit up to 5 points for recycled resins as follows:</p> <ul style="list-style-type: none"> ➤ 1 point for each percent (by weight) of post-consumer recycled resin <p style="margin-left: 40px;">1 X _____% post-consumer = _____ pts</p> <ul style="list-style-type: none"> ➤ .2 point for each percent (by weight) of pre-consumer recycled resin <p style="margin-left: 40px;">.2 X _____% pre-consumer = _____ pts</p> <p>Total Recycled Resin Score: <i>pre-consumer points</i> _____ + <i>post consumer points</i> _____ (5 point maximum)</p>	<p>_____</p>
<ul style="list-style-type: none"> <div style="display: flex; justify-content: space-between; align-items: flex-start;"> <div style="width: 60%;"> <p>C. 10% of the total resins purchased by your company are recycled resins (5 points)</p> <p>OR</p> <p>1 point for every 2% total resins purchased up to 5 points</p> </div> <div style="width: 20%; text-align: right;"> <p>_____</p> </div> </div> 	
<ul style="list-style-type: none"> <div style="display: flex; justify-content: space-between; align-items: flex-start;"> <div style="width: 60%;"> <p>D. 2.5% of the total resins purchased by your company OR > 2.5 million pounds are post-consumer recycled resins. (5 points)</p> <p>OR</p> <p>1 point for every 0.5% or 0.5 million pounds of post-consumer recycled resins</p> </div> <div style="width: 20%; text-align: right;"> <p>_____</p> </div> </div> 	<p>_____</p>

- **Paints & Coatings (3 point maximum)**
 The use of paints and coatings, including metal coatings, on plastic parts should be minimized. This product contains: *(choose one category only)*

 - no paints & coatings on plastic parts **3 points** _____
 - paints & coatings on plastic parts are proven to be compatible with recycling processes and do not significantly impact the physical/mechanical properties of the recycled resin **1 point** _____
 - paints & coatings on plastic parts not compatible or not proven compatible with recycling **-1 points** _____
 - exemption from paints & coatings criteria for parts with >25% recycled resins **1 point** _____

- **No molded in or glued-on metal parts (1 point)** **Yes/No** _____
 This product contains no enclosures with molded in or glued on metal parts unless minimized and easy to remove.

- **Parts >25 grams labeled per ISO 11469 (1 point)** **Yes/No** _____

- **Bio-derived Resins (3 points)** **Yes/No** _____